

**EL 6/2005 “Cuprona”**  
**Annual Report on Exploration**  
**September 2017 to September 2018**  
**- Lottah Mining Pty Ltd**

Grant MacDonald (B.Sc. Hons.), M.A.I.G.  
on behalf of  
Lottah Mining Pty Ltd  
15 Anglesea St  
Wivenhoe, Tasmania 7320

## **Abstract**

Attempts to negotiate compensation agreements with relevant landowners have failed to date and the mine lease application over the Northern Quarries deposit has been rejected by Mineral Resources Tasmania.

Preliminary rock sorting (Tomra) testwork of the Northern Quarries hematite deposit has sorted/upgraded 101.5kg at 48.4% Fe to a product of 58.5kg i.e. ~58% at a weighted average of 59.6% Fe, a DSO grade.

Further rock sorting testwork involving bulk sampling is planned for the coming months as well as drilling at Natone.

The results of a diamond drill hole drilled beneath the Copper King workings in March 2017 but not included in the 2017 annual report are included herein. The hole intersected a major fault zone, the Copper King Shear Zone, but with only very minor chalcopyrite mineralisation. Relatively undeformed feldspar phyric dykes were also intersected.

A DHEM survey down the hole recorded a possible weak off hole conductor which requires further surveying to model. Given the depth and potential size of this anomaly that work has not been justified.

## Table of Contents

	Page
<b>1.0 Introduction</b>	<b>1</b>
<b>1.1 Exploration Rationale</b>	<b>1</b>
<b>1.2 Location and access</b>	<b>1</b>
<b>1.3 Land status and usage</b>	<b>1</b>
<b>1.4 Tenure</b>	<b>1</b>
<b>1.5 Geology</b>	<b>2</b>
<b>1.5.1 Regional Geology</b>	<b>2</b>
<b>1.5.2 Geology of the Hematite Deposits</b>	<b>2</b>
<b>1.5.3 Geology of the Copper Deposits</b>	<b>3</b>
<b>2.0 Summary of Previous Work</b>	<b>8</b>
<b>2.1 Prior to Current Tenement</b>	<b>8</b>
<b>2.1.1 Iron Exploration and Mining history</b>	<b>8</b>
<b>2.1.2 Copper Exploration and Mining History</b>	<b>10</b>
<b>2.2 During Current Tenement</b>	<b>15</b>
<b>2.2.1 Iron Exploration</b>	<b>15</b>
<b>2.2.2 Copper Exploration</b>	<b>19</b>
<b>3.0 Exploration completed during the reporting period</b>	<b>20</b>
<b>3.1 Introduction</b>	<b>20</b>
<b>3.2 Mine lease application</b>	<b>20</b>
<b>3.3 Cuprona (Northern Quarries) metallurgical testwork</b>	<b>20</b>
<b>3.4 Copper King mine drilling and downhole EM</b>	<b>20</b>
<b>3.4.1 Introduction</b>	<b>20</b>
<b>3.4.2 CKDD1</b>	<b>20</b>
<b>3.4.3 Downhole EM</b>	<b>20</b>
<b>4.0 Discussion of Results</b>	<b>22</b>
<b>4.1 Mine Lease Application</b>	<b>22</b>
<b>4.2 Cuprona (Northern Quarries) metallurgical testwork</b>	<b>22</b>
<b>4.3 CKDD1</b>	<b>24</b>
<b>4.4 Down hole EM</b>	<b>28</b>
<b>5.0 Conclusions</b>	<b>31</b>
<b>6.0 Environment</b>	<b>32</b>
<b>7.0 Expenditure</b>	<b>33</b>
<b>8.0 References</b>	<b>34</b>
<b>9.0 File listing</b>	<b>37</b>

### Figures

1.1	Location of EL 6/2005	1
1.2	Blythe Mineral Field showing copper and iron prospects – north and central area, after Twelvetrees, (1905)	5
1.3	Blythe Mineral Field showing copper and iron prospects – central and south area, after Twelvetrees, (1905)	6
2.1	EL 6/2005 showing simplified geology and hematite deposits with respect to the port city of Burnie.	8
2.2	Copper King mine summary showing geology including Copper King shear zone, Department of Mines drill holes CK 1 to CK4 and 200ppm copper in soil anomaly compiled from Whitehead (1988).	12
2.3	Woodstock and Rutherfords copper workings showing summary of better exploration results to date (after Thomas and Henderson, 1943 and Grace, 1972).	14

2.4	Location of the Northern Quarries resource at Cuprona with historic and recent diamond and RC drillhole results (does not show 1986 CW Davis airtrack drill locations)	16
2.5	Northern Quarries (788) resource outline (maroon line) showing drillhole collars inc. 1986 CW Davis airtrack holes and traces with F % (legend in figure 2.6), and 30m pit option bounds.	17
2.6	Legend Fe % for figures 2.3 and 2.5.	17
2.7	Long section looking northwest, Northern Quarries resource, legend in figure 2.6.	18
4.1	Raw (left) and processed (right) XRT images of high and low-density particles. High-density particles are shown in blue/black, while low-density particles are shown in red. This image shows particles from the +25mm feed material using DE-XRT.	23
4.2	Cuprona samples showing weights and assays for each run	23
4.3	Copper King mine geology and drilling showing location of CKDD1.	26
4.4	Copper King mine long section showing the old workings and down hole geology for CKDD1 and earlier holes CK1, CK2, CK3 and CK4.	27
4.5	Loop layout for Copper King DDH CKDD1 DHEM survey.	28
4.6	Modelling of conductive overburden (aqua lines) and Copper King Shear (grey shape) with drill hole in green and loop in dark purple.	29
4.7	EM responses for all channels shown using the Maxwell interpretative/modelling software.	30

### **Tables**

2.1	Summary of Lottah's drilling at Cuprona	15
3.1	System specifications and acquisition parameters	21
4.1	Cuprona samples showing weights and assays for each run	23

### **Appendices**

A	CKDD1 drill hole details and log	38
B	Tomra Rock Sorting report	
C	Copper King drill hole CKDD1 DHEM survey	supplied digitally

## 1.0 Introduction

### 1.1 Exploration Rationale

Lottah Mining Pty Ltd has a JORC compliant magnetite iron resource at its Rogetta North project on ML 1996P/M to the south of EL 6/2005 as well as the JORC compliant hematite iron resource deposit on EL6/2005.

Lottah Mining Pty Ltd is targeting further magnetite and/or hematite iron deposits to add to its resource inventory.

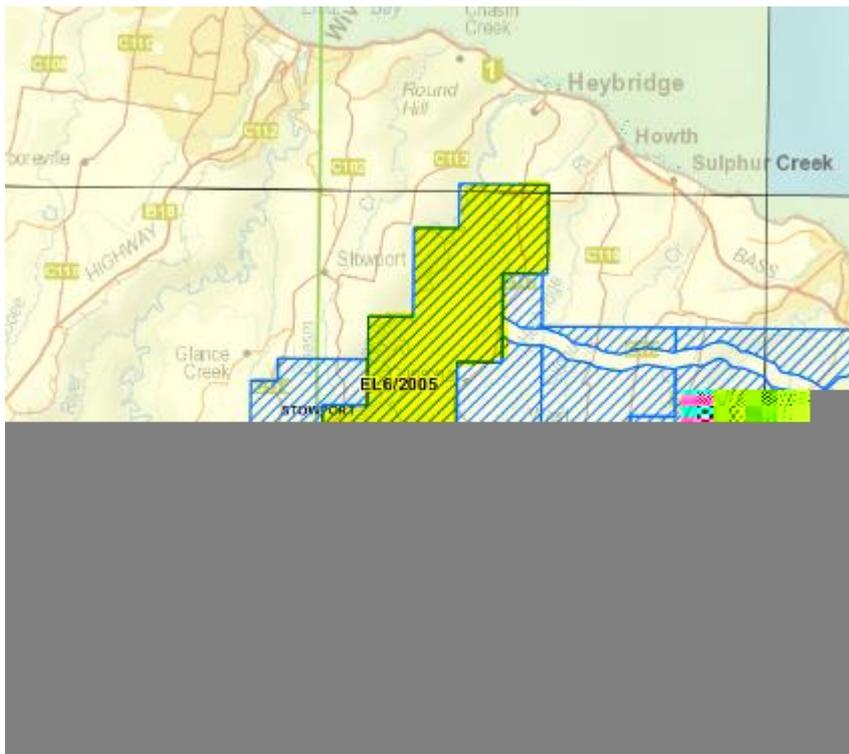
EL 6/2005 also has the potential for vein hosted copper mineralisation as evidenced by the Copper King mine and copper workings at Natone.

Lottah Mining Pty Ltd is also targeting any commodities of commercial interest including but not limited to W03, Sn, Bi, Mo, Cu, Pb, Zn, Au, Ag, Li, Ni, REE, wollastonite and facing stone.

### 1.2 Location and access

Exploration Licence 06/2005 (EL 06/2005) covers 22 square kilometres and is located 30 kilometres south-east of Burnie, close to the townships of Natone and Cuprona in North West Tasmania.

The primary access routes to EL 06/2005 is either Natone Road or Cuprona Road to the east. Smaller roads (including forestry) intersect the tenement. Access throughout the tenement is good.



**Figure 1.1: Location of EL 6/2005**

### 1.3 Land status and usage

Land use in the licence is predominantly agriculture with cropping and grazing both common. The exception is the Blyth River Reserve which is a state reserve.

### 1.4 Tenure

Tenement EL 06/2005 is held by Blythe River Iron Pty Ltd, managed by Lottah Mining Pty Ltd.

## **1.5 Geology**

### **1.5.1 Regional Geology**

Regionally the geology of the Rogetta Project area is dominated by a basement of Proterozoic metasediments (and minor mafic volcanics) of the Oonah/Burnie Formations unconformably overlain by a sequence of Cambro-Ordovician sediments, both intruded by the Devonian Housatop Granite, all obscured by a veneer of Tertiary basalt.

The basal unit of the Cambro-Ordovician sequence in the licence is the Owen Group sediments. Cambrian Mt Read Volcanics do not outcrop and have not been intersected in drilling.

The basal member of the Owen Group is a quartz pebble conglomerate, the Duncan Conglomerate, which contains local additions of volcanoclastic detritus. The conglomerates are overlain by the Moina Sandstone which has a gradational contact with the overlying Gordon Group Limestone, becoming more calcareous towards the contact.

These basement rocks were deformed in the Middle Tabberrabberran Orogeny under a largely east-west compressive stress regime. This resulted in the development of north to north-northeast striking F2 folds superimposed on a much broader east-west F2 fold. It also resulted in faulting in a range of orientations, however at least one dominant trend to faulting is north-northeast.

Late in the orogeny the I-type Housatop Granite was emplaced passively and underlies most of the Rogetta Project tenements.

Skarn mineralisation was introduced into calcareous rocks by fluids derived from this granite with rarer vein style mineralisation also associated with this intrusive. Whilst previously considered to be a single body more recent work (McKeown, 1994) suggests that the granite consists of a number of phases often intruding as dykes as opposed to a single large rounded batholith geometry.

Skarn mineralisation has formed in the carbonate bearing rocks of the Gordon Limestone and upper Moina Sandstone and in calcareous units in the Proterozoic Oonah Formation. Elsewhere regionally has also been skarn development in the Cambrian Tyndall Group rocks. Bedded hematite bodies, of which Cuprona is an example, lie near to the base of the Ordovician sequence but remain enigmatic in their genesis.

In the Tertiary topographic lows were filled by basal sediments followed by thick Tertiary basalt flows which spilled over onto more undulating topography as a thin veneer.

### **1.5.2 Geology of the Hematite Deposits**

Considerable geological work has been done over the last 125 years both by government and industry with a number of geological fact and interpretative maps, interpretative cross and long sections, drill hole geological logs and interpretative geological descriptions in reports produced during this time. In spite of this the geology and genesis of the hematite+silica bodies remains somewhat unclear though Gee's regional mapping of the Burnie quadrangle (Gee, 1968 and Gee, 1977) has provided the greatest insight.

Regionally the Blythe River Iron Deposits at Cuprona lie at the northeastern end of a +6km long hematite+silica mineralised trend which extends from Cuprona to Natone at the southwestern end.

The bodies range from 5m or less up to 30m in thickness, up to 430m long and apparently open at depth (except perhaps the Purple Crag outcrop).

The hematite+silica bodies are apparently stratiform within a ~100m thick unit of siliceous siltstone of Cambrian age and correlated with the Dundas Group. The siltstones form the basal unit of a regionally conformable Cambro-Ordovician sequence though locally unconformable contacts are noted (Gee, 1977), and are immediately overlain to the southeast by a quartz pebble conglomerate, the Duncan Conglomerate, containing siliceous and hematitic clasts.

Unconformably underlying the siltstones to the immediate northwest are polydeformed metasediments of the Proterozoic Burnie Formation.

Structurally the Cambro-Ordovician sequence at Cuprona and Natone lies on the western limb of a broad syncline with the sequence striking north easterly and dipping steeply to the southeast.

Similar hematite mineralisation is hosted in the same rocks at Penguin on the eastern limb of the syncline (Atkinson, 1958; Gee, 1977).

Hematite mineralisation occurs as massive earthy red hematite associated with silica in a massive to jointed and splintery rock. Silica occurs as splashes and blebs and appears to closely post-date the hematite.

Noldart (1966) describes the mineralisation intersected in Department of Mines drill holes BR1, BR2 and BR3 as follows. "The hematite generally is hard, compact, dark grey to reddish in colour with small vugs partly filled with crystalline hematite with occasional schistose and limonitic zones. Movement planes within the ore are faced with specular hematite. The silica is mainly dense and very fine grained, usually grading into iron giving a coarse mottled effect to the ore in the poorer sections, or occurring as smaller blebs and apparent vug fillings in the higher grade zones, giving a finely mottled appearance.

Brecciation zones are common in all intersections with the brecciation present in both higher and lower grade zones but more prominent in the siliceous sections of the ore body. Brecciation generally appears to have occurred after deposition of the iron but some post brecciation specular iron is present."

Within the individual ore lenses there does appear to be some internal zonation with high grade zones in the order of 3-8m thick, and commonly on the margins of the lense.

Whilst there are some structures described in the ore hematite mineralisation does not appear to be fault controlled. It is unclear as to whether this stratabound form reflects a primary sedimentary origin or a later preferential replacement of a favourable bed.

Gee (1977) discusses the genesis of the deposits remarking on the presence of clasts of hematite and limonite within the immediately overlying conglomerate.

Regionally the 1100m thick Duncan Conglomerate which overlies the siltstone is conformable with it. Gee (1977) notes that "In the Blythe River gorge at Cuprona, the base of the conglomerate is a poorly sorted breccia about 20 m thick, consisting of angular fragments of Proterozoic quartzite, siliceous siltstone, limonite and hematite, and rounded fragments of rare chert. Pebble size averages 3 cm, but ranges up to 15 cm. The matrix is a siliceous grit, and is replaced in part by limonite. Veins of specular hematite are present."

"The hematite ... (lenses) ... are probably replacement bodies in tectonic breccia zones within the Cambrian siltstone. Some of these bodies (*e.g.* Purple Crag) lie very close to the top of the siliceous siltstone and pass upward into a sedimentary breccia and conglomerate containing abundant clasts of hematite, limonite and Burnie Formation quartzite. This ferruginous rudite is the base of the Ordovician Conglomerate. The iron ore bodies were thus exposed prior to deposition of the Ordovician rocks, and the mixture of limonite and hematite, both *in situ* and as clasts, suggests a period of fossil gossanisation." (Gee, 1977)

This interpretation is highly significant as it suggests that the hematite "body" is much more regionally extensive than it might be if it was of more recent genesis.

The spatial relationship between hematite mineralisation and the parallel line of copper deposits offset just to the west is mentioned by a number of authors as suggesting a co-genesis, however, the copper lode at the Copper King mine is transgressing the strata making it post-sedimentary. It is more likely that that iron rich oxidised fluids, buffered by the nearby hematite bearing rocks, met and mixed

with ascending reduced copper bearing fluids, precipitating copper iron sulphides, thus explaining the spatial association.

### **1.5.3 Geology of the Copper Deposits**

A northeast striking belt of abandoned copper mines runs parallel to (offset to the west) the Cuprona-Natone hematite iron trend.

At the southern end of the belt are the Woodstock and Rutherfords abandoned mines. In the centre on either sides of the Blythe River are the Commonwealth and North Commonwealth with the Cuprona Copper King mine and Evans workings on the eastern slopes, and at the northern end are the Edwards, Smiths and Bramichs lodes. The most significant of these is the Copper King mine. The locations of these are illustrated in figures 1.2 and 1.3 after Twelvetrees (1905).

The copper lodes are hosted in slates and sandstones of the Burnie Formation. The Burnie Formation here consists of multi-deformed Proterozoic metasediments which strike northeasterly. In the mine area they dip moderately to steeply to the northwest.

The copper lodes occupy shear zones which cut across lithological boundaries, striking northeasterly and dipping steeply southeasterly. Whilst the Copper King Shear Zone is the major copper bearing shear, there are other parallel mineralised shears.

As Twelvetrees (1905) note “though the line of mineralisation right through from Rutherford's is a long one, it does not follow that one and the same lode continues through without interruption. It is more likely that the lode shoots tail out and separate ones start, not exactly on the same line, but on parallel lines, the whole, however, forming a mineralised belt which is continuous all through these mining sections.

Regarding the copper mineralisation in the Copper King mine an anonymous geologist in Butler (1970) states that “In old reports the ore zone is described as sub-vertical, dike-like, 30' in width, and part of an intermittent line of copper mineralisation running NE to the coast and SW towards Devonian granite. The lode material is variable in nature, mainly consisting of massive quartzose rock with veins of copper-bearing ore at intervals. Elsewhere it consists of chalcopyrite in a gangue of slate, with veins and patches of quartz and siderite and disseminations of pyrite. Oxidation to cuprite, native copper and carbonates is common. Payable ore is mainly confined to the footwall (west (sic) side) and in places occurs in the graphitic slate outside the footwall.”

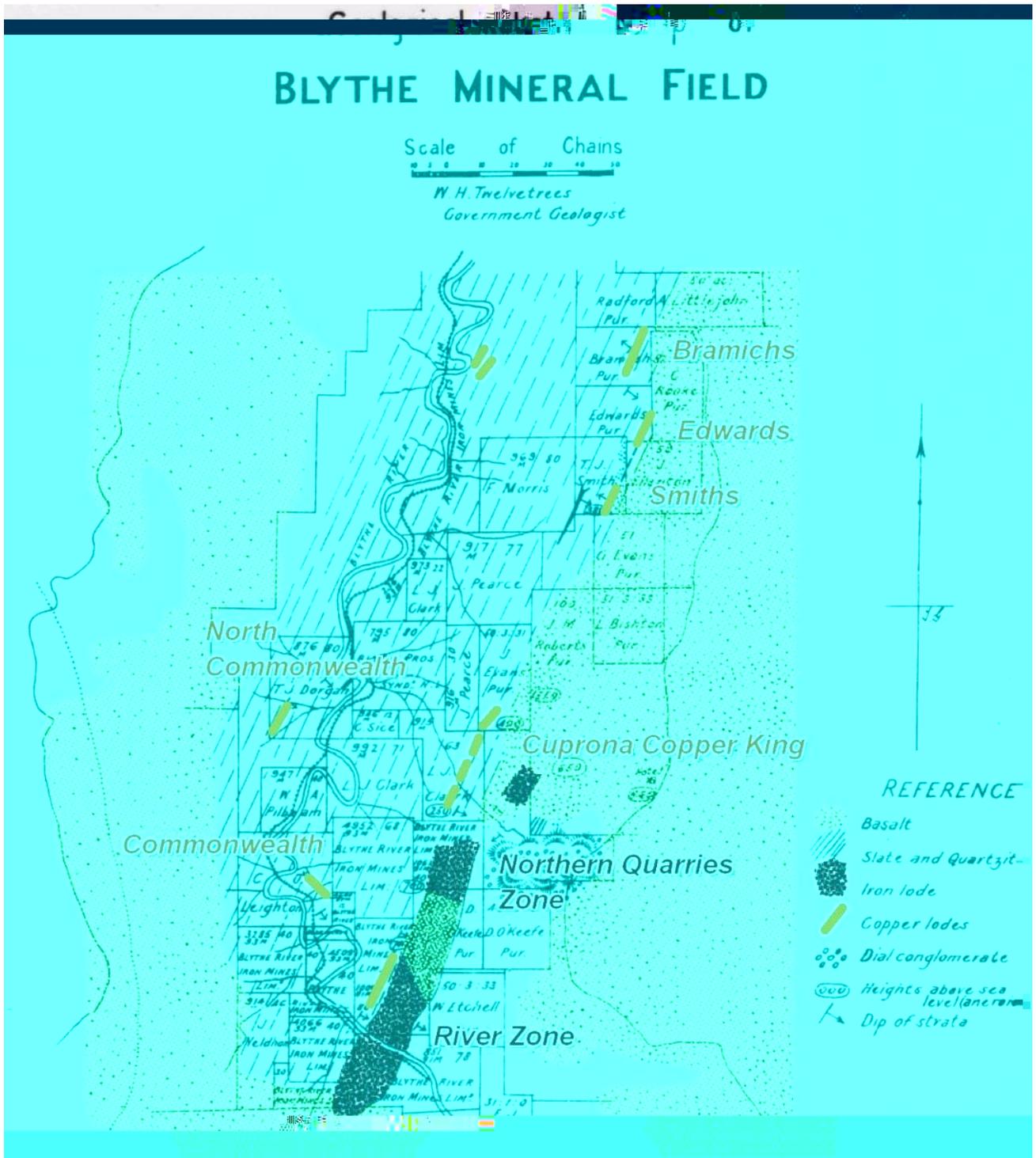


Figure 1.2: Blythe Mineral Field showing copper and iron prospects – north and central area, after Twelvetrees, (1905)

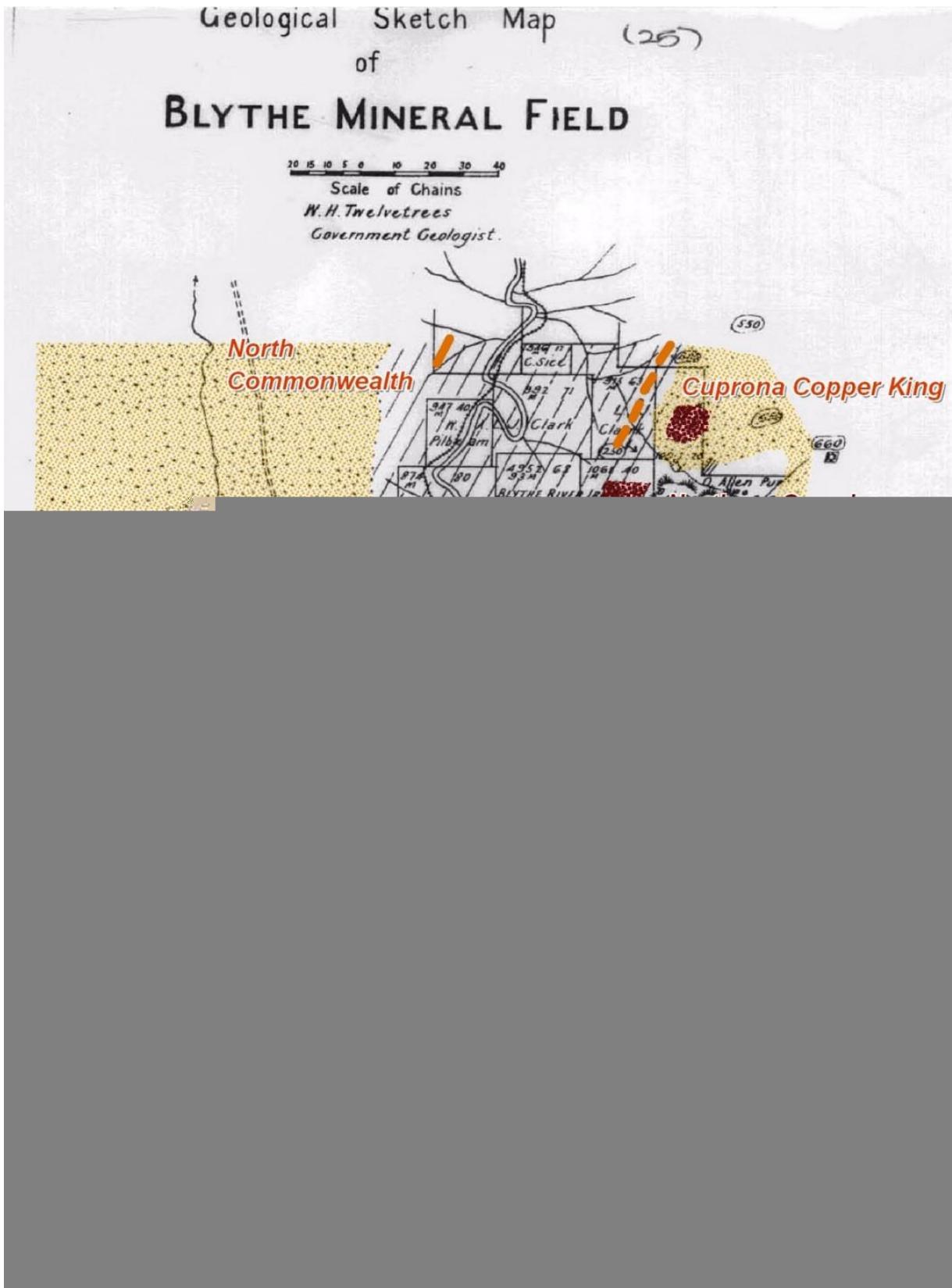


Figure 1.3: Blythe Mineral Field showing copper and iron prospects – central and south area, after Twelvetrees, (1905)

Twelvetrees (1905) visited the Copper King mine during its operation and provides descriptions of the lode as exposed in the workings at the time. He states that the 100' long No.2 tunnel, "driven 31' across the lode formation" (in a westerly direction) was "the only place in the mine where the full width of the lode has been proved." "Some seams of copper ore occur at the immediate entrance to the tunnel ... some nice-looking red and black oxides of copper show in this seam. The ... tunnel passed through alternate bands of hard rock and black copper ore. For 11 feet the lode matter intersected was poor, but afterwards about 10 feet of gossanous material came in and yielded the ore which is piled outside (12 tons at 7% Cu). The adit has been driven right through the lode channel to the graphitic slate country on the east wall." "Towards the end of the drive the lode is carried along the east wall, showing some copper stains and oxidised ore. A cross-cut east is necessary to tap the richer part of the lode." (Twelvetrees, 1905)

In the Upper (No.1) Tunnel, a narrow crosscut tunnel driven west 100', the lode "has been carried the width of the drive but extends outside the west wall for at least 23 feet." "The formation as disclosed in this cross-cut consists of massive quartzose rock with veins of copper bearing material at intervals." (Twelvetrees, 1905).

Twelvetrees (1905) summarises saying "The line of lode is a persistent one, and of considerable width, nearly half a chain. The formation must not be looked as payable all through this width. The footwall portion seems to be that in which payable ore is most largely developed, though at the same time there are bands of ore elsewhere in the formation which will make frequent cross-cutting necessary. The ore deposition partakes of the irregularity which characterises most lodes, but the large quantities of oxidised ore indicate the probability of a strong pyritic lode at depth."

Regarding the nature of the copper mineralisation in the Rutherfords and Woodstock mines Gee (1977) states "the deposits are similar to those of the Copper King Mine, and consist of isolated veins of quartz containing pyrite and chalcopyrite. The veins penetrate quartzite and slate of the Burnie Formation within a 100 m wide NE-trending zone.

The lodes near the surface are capped with limonitic gossan and in the shallow adits Nye (1941) recorded supergene alteration with bleaching of the slate adjacent to the lodes and development of secondary covellite and sulphate ... The lodes are generally narrow and discontinuous, ranging in strike from 040° to 320° and dipping steeply west." (Gee, 1977).

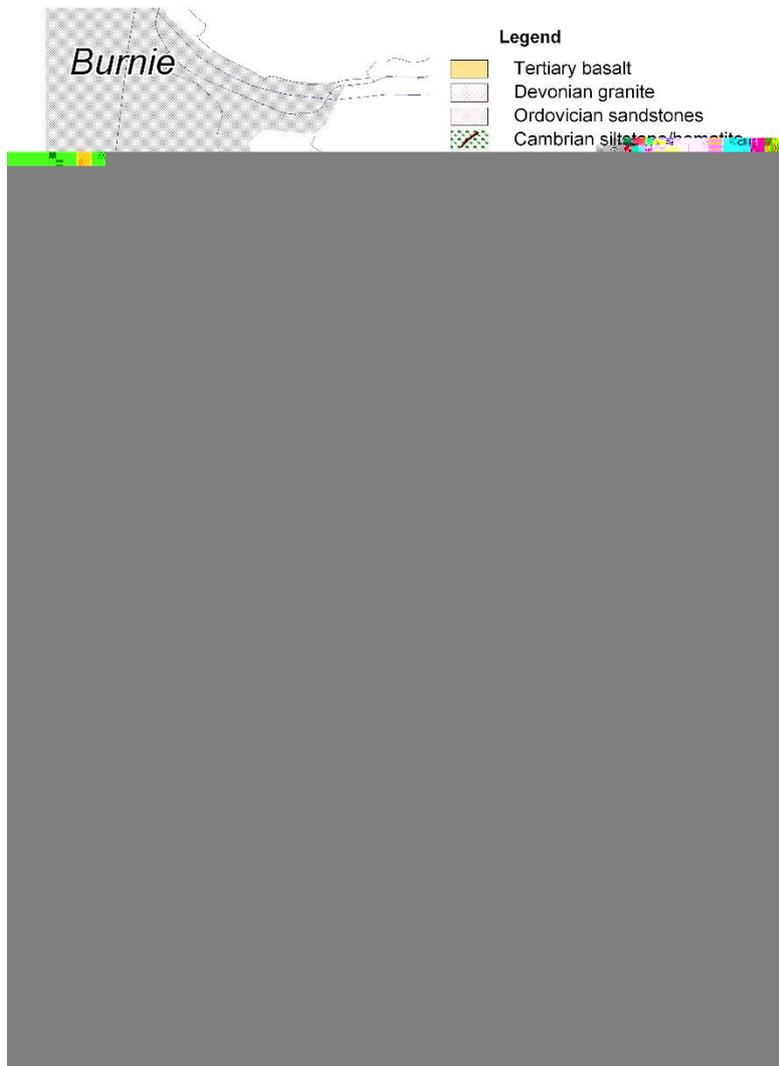
Thomas and Henderson (1943) summarised the geology as follows. "The gossanous outcrops extend along a belt of fracturing which trends north east. Along these fractures copper lodes, with a little gold and silver, have been formed. The occurrence of these gossans in isolated patches points to a lack of continuity of the ore bodies and their development as lenses as the intersection of the fracture systems. This is corroborated by the exposures in the underground workings." (Thomas and Henderson, 1943).

## 2.0 Summary of Previous Work

### 2.1 Prior to Current Tenement

#### 2.1.1 Iron Exploration and Mining history

The Cuprona-Natone area has long been associated with prospecting and mining, with the first mining lease being granted in the area in 1891.



**Figure 2.1: EL 6/2005 showing simplified geology and hematite deposits with respect to the port city of Burnie.**

At Cuprona the Blythe River and Cuprona Hematite Iron deposits were discovered during the 1890's by private explorers. Their leases were eventually transferred to Blythe River Iron Mines Limited in around 1900, and an extensive sampling program including surface trenching and aditing was carried out with a 1,000 tons bulk sample quarried for metallurgical testing. A 6.5 mile (10.5 km) spur line was also surveyed to meet the main government railway at the mouth of the Blythe River to carry the ore to Burnie for shipment to proposed smelters NSW but it was never built.

In 1919 the project was offered to the Commonwealth Government who had an independent investigation carried out by Boyd, Gibson and Young to determine the viability of the deposits. These investigators reported that the deposits contained "9 million tons of iron bearing material..." however ".....the bulk of the deposit is far too siliceous to be considered as an iron ore at the present day and the quantity of good ore is too small to be considered of any economic importance".

Another geological and economic study of the deposits was carried out by Nye in 1937 on behalf of J. D. Patterson, the new owner of the leases, as part of a submission to the Tasmanian government for assistance to construct the rail spur up the Blythe River valley. This report effectively confirmed the Boyd, Gibson and Young conclusions.

In 1940-1941, the Australian Commonwealth Carbide Company quarried 2,555 tons from the Northern Quarries area for use in ferro-silicon manufacture.

As part of a general appraisal of iron ore deposits in Tasmania Blake in 1957 mapped and reported on the Blythe River and Cuprona iron deposits. No new resource estimates were calculated although he stated that it was "proved" that only 12,000 tons of high grade iron ore was located at Purple Crag.

In 1958 Atkinson reported for CRA that the Blythe River iron deposit had a potential for 10 million tons of siliceous iron ore with good potential for extensions below the Tertiary basalts to both the north and south. No grades were quoted.

In 1962 beneficiation tests on two 9 cwt. (approx. 450kg) bulk samples collected from the Blythe River deposits were carried out by the Tasmanian Mines Department to determine if beneficiation of the siliceous hematite could produce a +60% Fe concentrate suitable for export.

Further Tasmanian government mapping was carried out by Gee in the early 1960's that culminated in a three hole diamond drilling program at Northern Quarries reported by Noldart in 1966. The drilling was described as confirming the theory put forward by Gee that the iron deposits are localised in an interformational breccia located on the unconformity between the Precambrian quartzites and the overlying Ordovician sediments.

The iron ore intersected was of variable grade having a true width of approximately 80 feet (24m) for 45.3% Fe and 36.6% SiO<sub>2</sub> in BR1 from a depth of 124.25 feet (38m) (see Figure 3), 65 feet (20m) in BR2 from 79.8 feet (24m) and 88 feet (27m) for 26.6% Fe and 57.6% SiO<sub>2</sub> in BR3 from 57 feet (17m). Drill hole BR2 was not sampled and assayed due to poor core recovery. Noldart recommended that any further exploration should be concentrated to the south of BR1 up to and below the Tertiary basalt cover.

The hematitic ironstone at Natone was first mined by the owner of the property Mr T Rutherford on or about 1919. Workings consisted of two shallow shafts.

In 1938, J. Linell Cook (Holdings Pty. Ltd.) reportedly further prospected the area by shaft sinking and trenching and contracted the Department of Mines to drill two diamond drill holes (Bore 1 and Bore 2).

Thomas and Henderson (1943) describe extensive work then recently completed and ongoing by a company Ferrico Proprietary Limited who had sunk 4 shallow shafts (3 with cross-cut drives at their base) and cut numerous trenches. Intriguingly their mining work stopped when ore was reached as they were unable to successfully break the very hard siliceous hematitic ore.

During the late 1960's through to the mid 1990's most exploration regionally switched from iron ore to base metal skarns that may have formed within the Oonah Formation where potentially mineralised fluids generated by the emplacement of the Husetop Granite were deposited in favourable lithologies. The majority of exploration appears to be focussed on tin (Sn), tungsten (WO) and/or copper (Cu) mineralisation.

Minops investigated the Natone area from 1968 to 1972 following on from the BMR regional magnetics survey which had defined a major aeromagnetic anomaly in the area. Their work included magnetics, IP, auger drilling and the drilling of 3 diamond drill holes (Natone 1, 2 and 3) by the Department of Mines drill rig totalling 506m.

Hole 1 targeted the main magnetic anomaly to the west as did hole 3 intersecting weathered sediments grading into quartzite hornfels with minor tremolite/actinolite rock and calc-silicate skarn with pyrrhotite likely responsible for the magnetic anomaly.

Hole 2 (Natone 2) targeted the easterly weaker magnetic anomaly and intersected a 125' (horizontal width assuming vertical dip) zone of 53% Fe in massive hematite (Jack, 1969).

During 1969-1974, within EL 1/69, the Tasminex/ANZECO J/V investigated the Natone ironstone and Rutherford's copper prospect, to the north, with soil and rock geochemistry, mapping, magnetics and costeaning and the drilling of 5 shallow percussion totalling 106m at Rutherfords copper prospect.

During 1977-1985, EL 8/77 was investigated by the Comalco-Shell-CRA J/V. Extensive exploration focussed on the skarned rocks towards the discovery of tin-tungsten deposits included mapping, stream, rock and soil geochemistry: aeromagnetic and INPUT EM surveys, SP, IP max-min EM, SIROTEM, gravity and the drilling of three diamond drill holes NT1, NT2 and NT3. Drill hole NT3 encountered significant magnetite mineralisation intermixed with pyrrhotite.

No holes have intersected significant levels of W, Sn, M or Bi.

During 1986-1989, within EL30/1986, CW Davis undertook stream geochemistry, mapping, rock chip sampling and at the Cuprona ironstone drilled 28 airtrack holes totalling 252m.

Throughout the 1993-1995 period, within EL 9/92, Pasminco reviewed the regional geological setting, flew airborne magnetics/radiometrics, and collected and analysed rock chip samples.

In 2005, Red River Resources (RRR) pegged the current EL 6/2005. Work carried out during the first year included: literature review, field investigations of the hematite/quartz outcrops, modelling of potential magnetic targets and a review of aeromagnetic data.

Red River Resources (RRR) also initiated a detailed gravity and soil geochemical sampling survey over the Natone prospect. Access was limited due to an uncooperative land owner, and thus data was somewhat limited. Upon reviewing this data, (RRR) commenced a drilling programme on the Kiwi prospect and Natone Skarn (permit year 2006-2007).

In 2006 Red River Resources drilled 5 holes (RRN1 to RRN5) for 721.7m. Their first hole RRN1 attempted to twin Shell hole NT3's magnetite intersection. The other 4 holes targeted soil (copper mainly but also gold, silver, palladium) +/- gravity anomalies. Holes were assayed for Cu, Pb, Zn, Ag, Au and Sn but not Fe. Hole RRN5 intersected bands of hematite in clay from 0 to 48.2m. The other holes intersected sediments with some calc-silicate skarn development.

Upon joint venturing into the project Iron Mountain Mining Limited drilled 5 RC holes (KWRC1 to KWRC5) for 254m (anon. 2008) into Rutherfords workings. These holes all intersected varying quantities of hematite+/-minor magnetite mineralisation with better results 8m @ 57.6% Fe and 3m @ 55.5% Fe.

In 2013 Tasmania Mines Ltd drilled three diamond drill holes R001, R002 and R003 into the Rutherfords prospect. All holes were angled to the southwest and all intersected hematite mineralisation with R001 intersecting 66m @ 45.5% Fe including 13m @ 58.5%.

### **2.1.2 Copper Exploration and Mining History**

It appears that copper was discovered in the area in the early 1900's.

The most significant abandoned copper mine is the **Copper King mine** in the centre of the belt. The location of this and other mines in the centre and northern part of the belt are shown in figure 1.

The mine operated between 1904 and 1917 producing 1331 tons of ore between 1904 and 1909 grading 16.7% Cu (Butler, 1970). Early government reports describe a "lode formation" up to 9m wide though payable copper only occurred in more discrete veins within this zone.

The mine was worked by open cut on surface with an inclined shaft and levels at 62', 83' and 100' with an adit at creek level accessing the 83' level also.

At the time of his visit in 1905, Twelvetrees saw a Lower Adit (150' level), Upper Adit (100' level) and a smaller adit with another adit on the line of lode a few hundred feet to the north.

Subsequent work saw the mining of a main shaft to 150' deep, now filled in, and another smaller shaft 100' north reportedly on good showings.

The mine has been investigated by a number of companies. In Quest Exploration investigated the mine in 1965/66 and considered re-opening it.

In 1966 the Department of Mines drilled 4 shallow diamond drill holes for 286.3m into the Copper King shear on three sections. Two holes hit the lode, a third does not appear to have done so and a fourth was deliberately targeted away from the lode. Intersections of the lode are described as sludge in two of the holes. The locations of these holes are shown on figures 2.2 and ????

Pickands Mather carried out a programme of gridding and soil sampling in 1970.

An anonymous Pickands Mather geologist (?) in Butler (1970) states that 31,800' of gridding had been completed, 157 soil samples collected and 16 stream sediment samples taken. Two lines were read for ground magnetics (4N and 8N) and the grid was reportedly covered with a 'Broadside' EM survey (14000' surveyed). The results of this EM survey have not been sighted. A 200ppm copper soil anomaly corresponds with the old mine workings (see figure 2.2)

Butler also (1970) shows a design for a drill hole to intersect the lode 150' below the creek level. The hole was not drilled.

In 1988 CW Davis investigated the mine with some limited sampling (Whitehead, 1988). They also re-assayed the Department of Mines drill core with best result 2.1m down hole at 0.25% Cu in CK2.

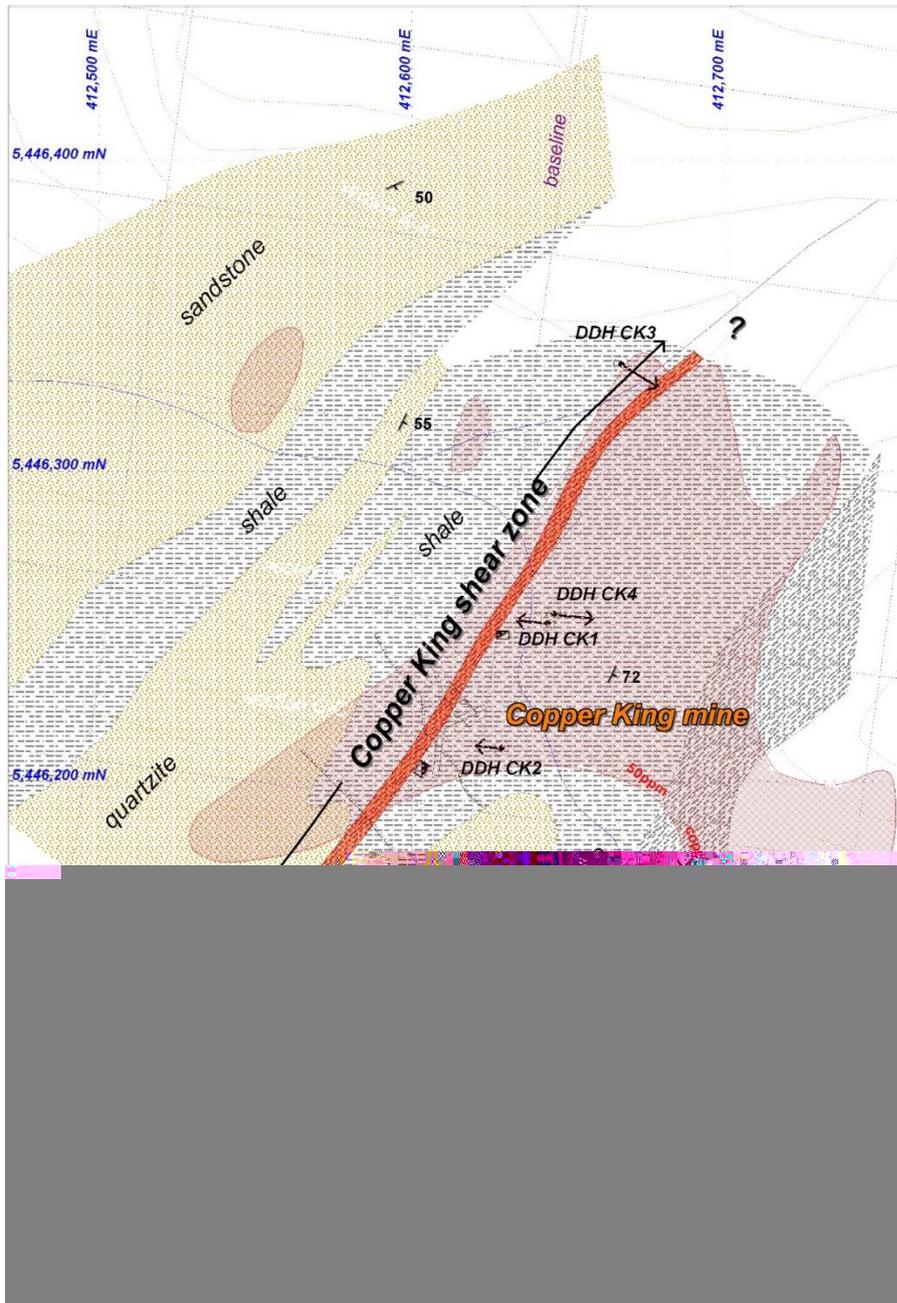
The **Evans** workings lie 400m north of the Copper King mine where a 20' adit cross-cuts slates (Twelvetrees, 1905). It is not clear as to whether the adit intersects the Copper King line of lode. Mapping in Whitehead (1988) shows the Copper King shear turning more easterly at its northern end away from Evans workings.

The **North Commonwealth** mine (Twelvetrees, 1905) consisted of a surface cut and an 80' adit. The former intersects slates with pug seams and a 2'-18" wide quartz vein at its end. The tunnel intersected quartzites and pyritic black slates.

The **Commonwealth** mine consists of a 280' adit driven to intersect a lode outcropping on the hill and a shaft on the lode which consists of "indurated slate and quartzose rock traversed by parallel veins of quartz, crossed in all directions by veinlets of the same mineral." (Twelvetrees, 1905). At the entrance a pyritic seam was intersected with a few similar seams intersected further in.

At the northeastern end of the field are Edwards, Smiths and Bramichs workings.

At the abandoned **Edwards** mine, also along strike from the Copper King, an adit has been driven 40' intersecting a "soft seam of soft slate" (Twelvetrees, 1905) at the tunnel entrance before passing through quartzite then back into slate. A little chalcopyrite has been got in the adit with a surface cut to the south exposing native copper.



**Figure 2.2:** Copper King mine summary showing geology including Copper King shear zone, Department of Mines drill holes CK 1 to CK4 and 200ppm copper in soil anomaly compiled from Whitehead (1988).

At **Bramichs** an 18' adit completed in 1904 targeting splashes of copper in slate seen in the creek intersected splashes of chalcopyrite in black slates but no strong lode structure. "No body of ore has been discovered, but a good deal of mineral is scattered through the rock in these workings, and it may well be that there is more ore in the neighbourhood." (Twelvetrees, 1905)

**Smiths** workings consisted of surface cuts across a lode intersected in one cut as 11' in width with "1 foot of quartz on the footwall, succeeded by soft puggy slate in patches, graphitic slate containing lumps of dense iron pyrites, and dark slate with curved laminae, measuring with the quartz 4 feet in width. Seven feet of hard micaceous rock underlies the footwall quartz, and outside this slate again

with veins of quartz and pyrites. The puggy slate 10 the lode is also vemed with quartz. A little copper pyrites is present, associated with carbonate of iron and quartz.” (Twelvetrees, 1905)

At the southwestern end of the field are the Rutherfords and Woodstock abandoned mines (locations in figures 1.2, 1.3 and details in 2.3).

At the time of his visit in 1905 the **Rutherfords** copper mine (ca. 1900; Twelvetrees, 1905) consisted of a 150’ tunnel and a smaller shaft with cross-cuts at 16’ and 32’. A main shaft had commenced and was at 99’ with a cross-cut at 95’ and 70 tons of ore was at surface. Twelvetrees (1905) reported that “in addition to about 7% copper the ore carries 3½ ozs. silver per ton”.

Twelvetrees (1905) describes lode widths of 1’ to 3’, averaging 12”-18”. The ore is chalcopyrite and a black copper oxide and the lode strikes northeasterly, dipping northwesterly.

The **Woodstock** copper mine was visited by Henderson (1941) who mapped and sampled the old partly collapsed old workings on behalf of L.J. Clark who was undertaking prospecting operations..1363.Josted

Tasminex explored the Woodstock/Rutherfords area in the early 1970's (Grace, 1972) with a programme of soil sampling, geophysics, backhoe trenching and the drilling of 5 shallow open percussion holes. Only one hole successfully reached its target intersecting 15' @ 0.52% Cu.

The trenching intersected the Rutherfords lode in 4 trenches with best results 5' @ 6.0% Cu and 10' @ 4.45% Cu.

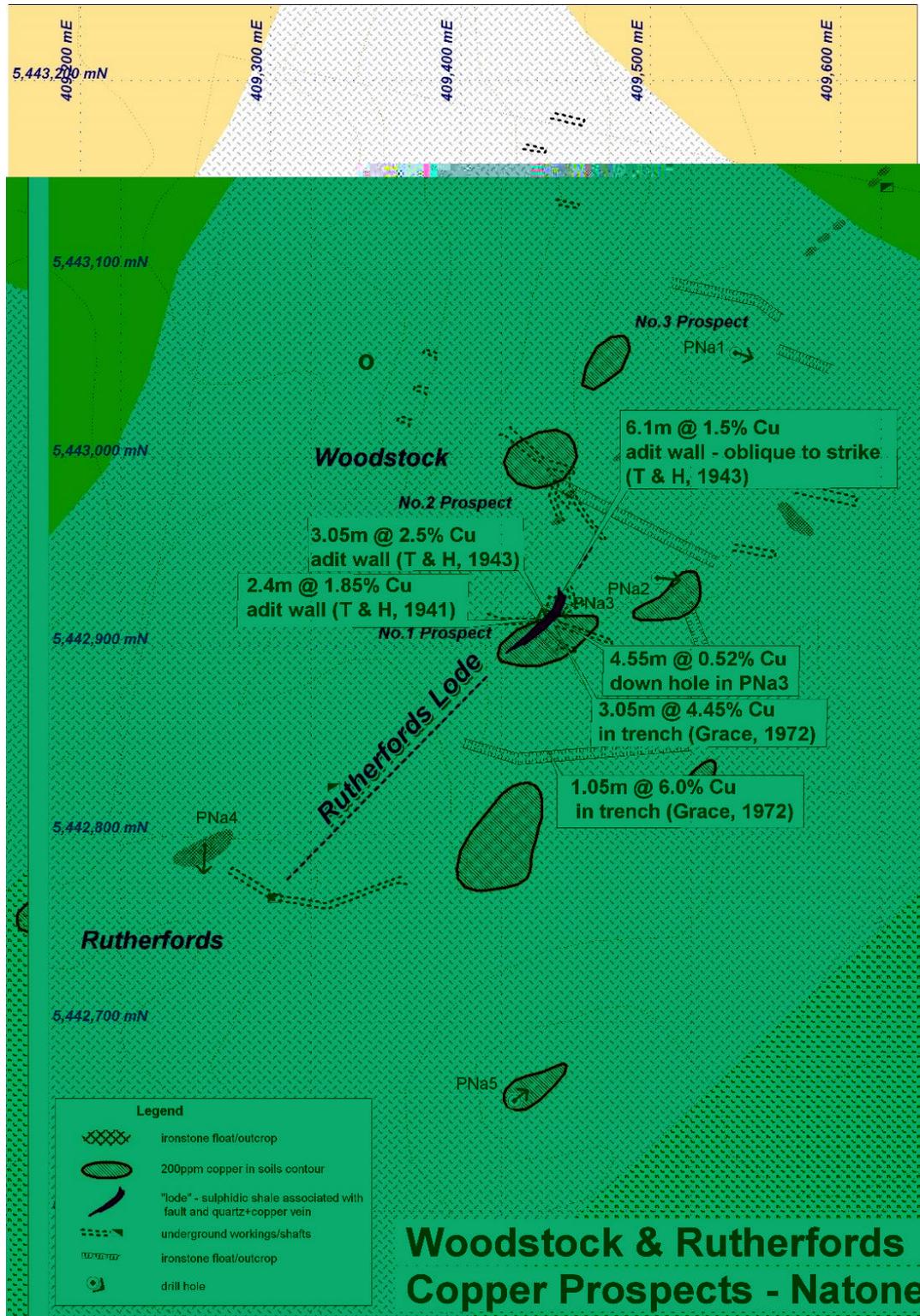


Figure 2.3: Woodstock and Rutherfords copper workings showing summary of better exploration results to date (after Thomas and Henderson, 1943 and Grace, 1972).

## 2.2 During Current Tenement

### 2.2.1 Iron Exploration

The current tenement extends from near the coast southwesterly to Natone and includes both the Natone and Cuprona cluster of hematite deposits.

In 2015 LMPL conducted two phases of drilling at Cuprona. A total of 16 drillholes were drilled (11 RC holes and 5 diamond drill holes) in and around the more accessible deposits at the northern and southern ends of the trend. A summary of the drill holes is below;

- Diamond drill holes 15CUN005DD, 15CUN006DD, 15CUN008DD and 15CUN010DD, and RC holes, 15CUN004 RC, 15CUN007 RC and 15CUN009RC were drilled into the Northern Quarries (788) deposit.
- RC holes (15CUN00RC1 and 15CUN00RC2) targeted a magnetic anomaly just east of the hematite mineralised trend. This anomaly had been tested by Shell with drill hole CUPD1.
- RC hole 15CUN00300RC was drilled just west of the main body testing for parallel mineralisation based on a mistaken belief on the location of historic holes BR1 to BR3.

South of the river diamond drill hole 15CUS009DD tested the Purple Crag deposit, RC hole 15CUS003RC tested the Eastern Crag deposit and RC holes 15CUS001RC and 15CUS002RC tested south along the main trend with 15CUS004RC and 15CUS005RC off to the east of this main trend.

**Table 2.1 Summary of Lottah's drilling at Cuprona**

Hole or channel ID	Easting (MGA94)	Northing (MGA94)	RL (m.a.s.l.)	Length (m)	Azimuth (true)	Dip	Sample type	Company
15CUN001RC	412429.692	5445236.894	264.717	205	360	-90	RC	Lottah Mining Pty Ltd
15CUN002RC	412442.553	5445404.769	274.014	192	360	-90	RC	Lottah Mining Pty Ltd
15CUN003RC	412248.577	5445689.84	198.388	156	140	-60	RC	Lottah Mining Pty Ltd
15CUN004RC	412579.391	5445709.783	224.314	103	320	-60	diamond	Lottah Mining Pty Ltd
15CUN005DD	412376.7	5445579.715	232.671	170.1	140	-55	diamond	Lottah Mining Pty Ltd
15CUN006DD	412449.618	5445672.958	227.011	143.7	130	-85	diamond	Lottah Mining Pty Ltd
15CUN007RC	412533.154	5445674.023	230.45	100	320	-60	RC	Lottah Mining Pty Ltd
15CUN008DD	412622.968	5445792.373	212.175	32.8	320	-55	diamond	Lottah Mining Pty Ltd
15CUN009RC	412418	5445644	230.026	124	140	-60	RC	Lottah Mining Pty Ltd
15CUN010DD	412622.164	5445791.534	212.175	59.8	147	-70	diamond	Lottah Mining Pty Ltd
15CUS001RC	411572.711	5444116.412	226.992	171	320	-55	RC	Lottah Mining Pty Ltd
15CUS002RC	411545.21	5444427.4	164.541	129	305	-55	RC	Lottah Mining Pty Ltd
15CUS003RC	411749.947	5444449.042	184.813	61	320	-55	RC	Lottah Mining Pty Ltd
15CUS004RC	411917.882	5444300.366	195.218	40	60	-55	RC	Lottah Mining Pty Ltd
15CUS005RC	411917.345	5444299.24	194.961	140	320	-55	RC	Lottah Mining Pty Ltd
15CUS009DD	411817.625	5444781.464	59.3	150.5	130	-55	diamond	Lottah Mining Pty Ltd

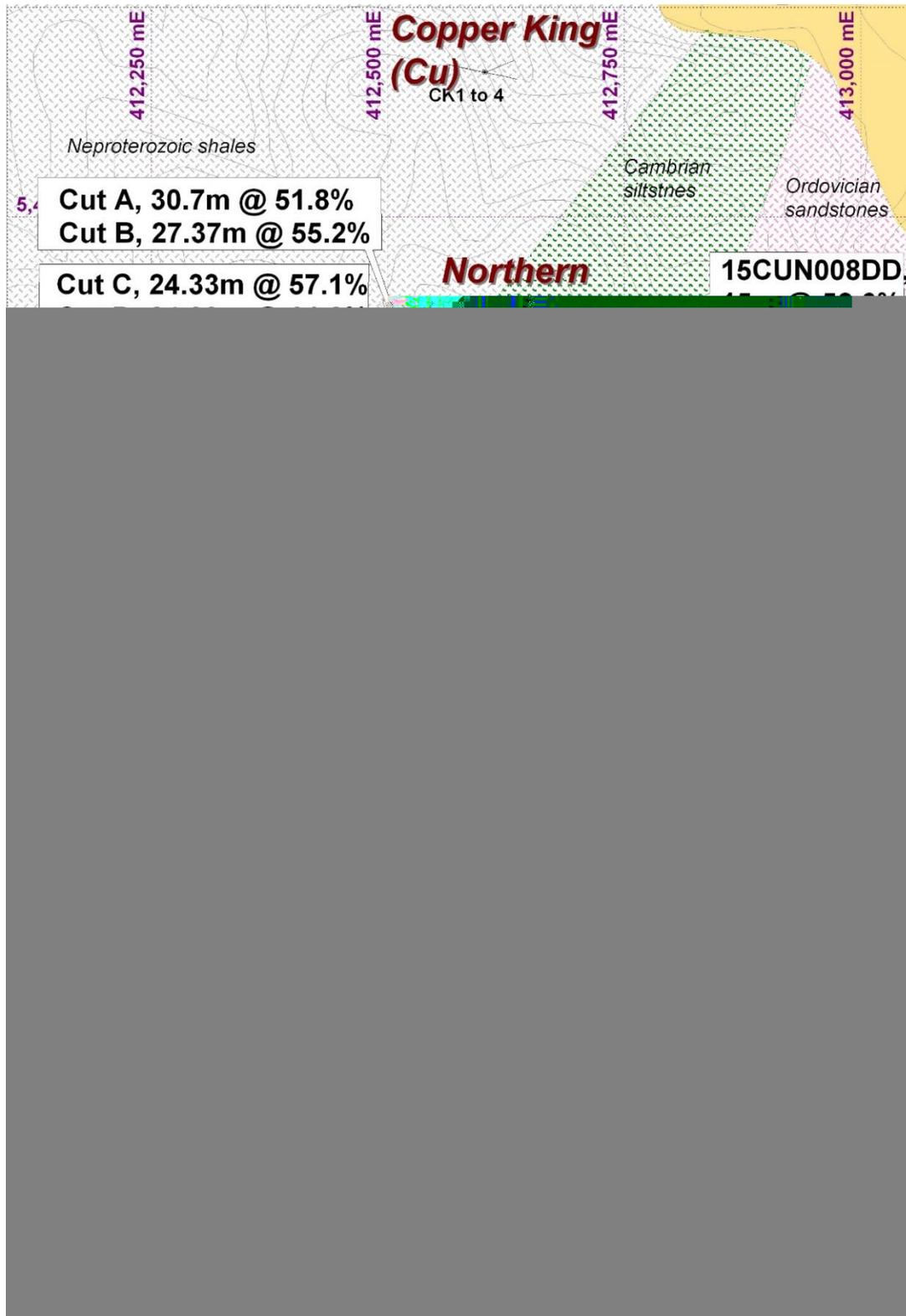
In 2016 a resource was estimated for the Northern Quarries deposit at Cuprona. This work was redone in 2016/17 utilising extra historical data and new structural data. The re-estimated resource was classified as Inferred on the basis of

1. the use of historical data from four sources with inherent potential positional inaccuracies in sample location, and
2. non-existent or inadequate QA/QC.
3. mixed data (four) sets with no field duplication.
4. use of dummy assay data

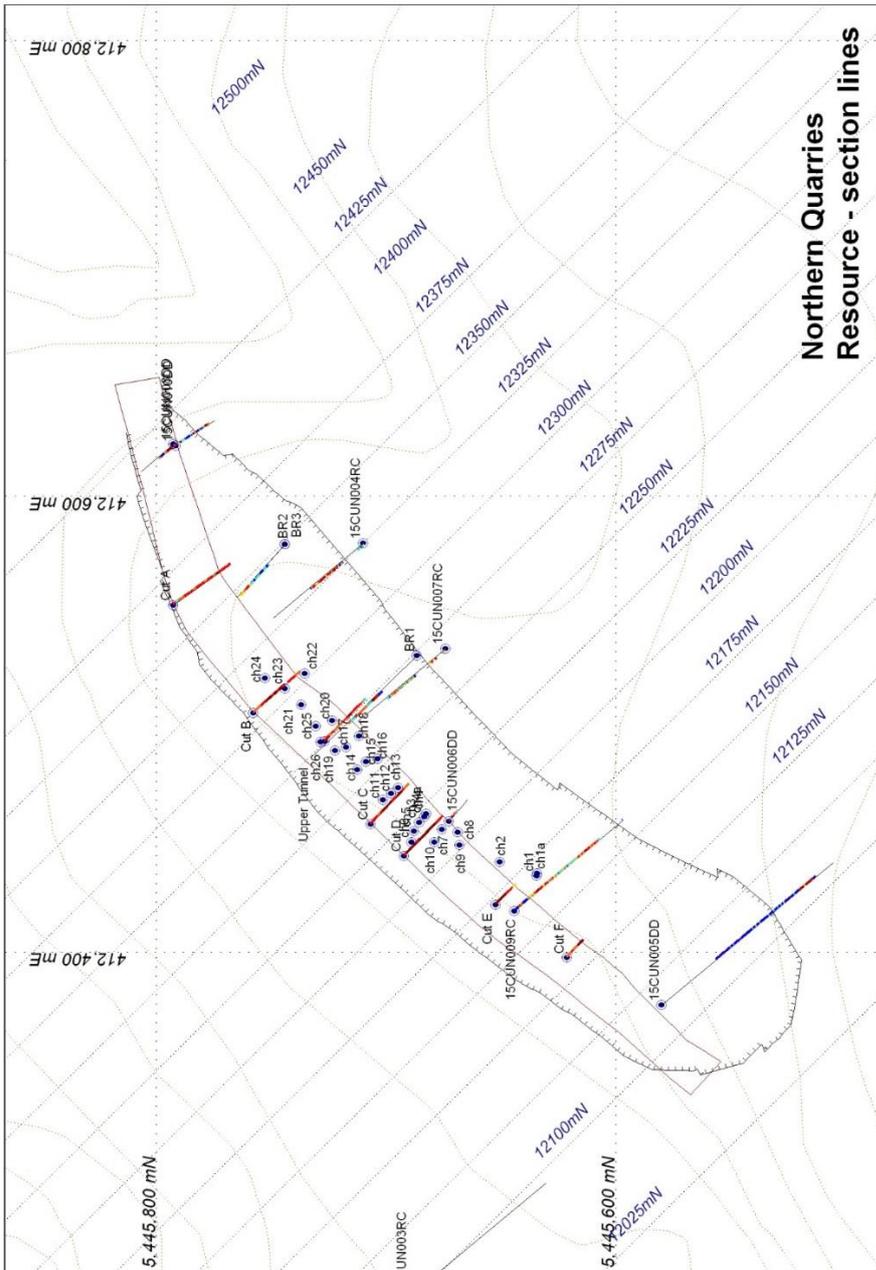
The total resource stands at **4,506,180t at 41.13% Fe** (and 34.15% SiO<sub>2</sub>).

A 30m pit option modelled contains a total resource is **947,248t at 47.72% Fe** (and 27.12% SiO<sub>2</sub>).

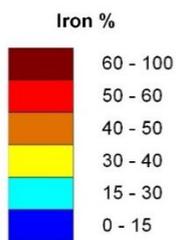
Subsequent to this an application for a Mining Lease over the deposit was submitted to Mineral Resources Tasmania.



**Figure 2.4: Location of the Northern Quarries resource at Cuprona with historic and recent diamond and RC drillhole results (does not show 1986 CW Davis airtrack drill locations)**



**Figure 2.5: Northern Quarries (788) resource outline (maroon line) showing drillhole collars inc. 1986 CW Davis airtrack holes and traces with F % (legend in figure 2.6), and 30m pit option bounds.**



**Figure 2.6: Legend Fe % for figures 2.3 and 2.5.**

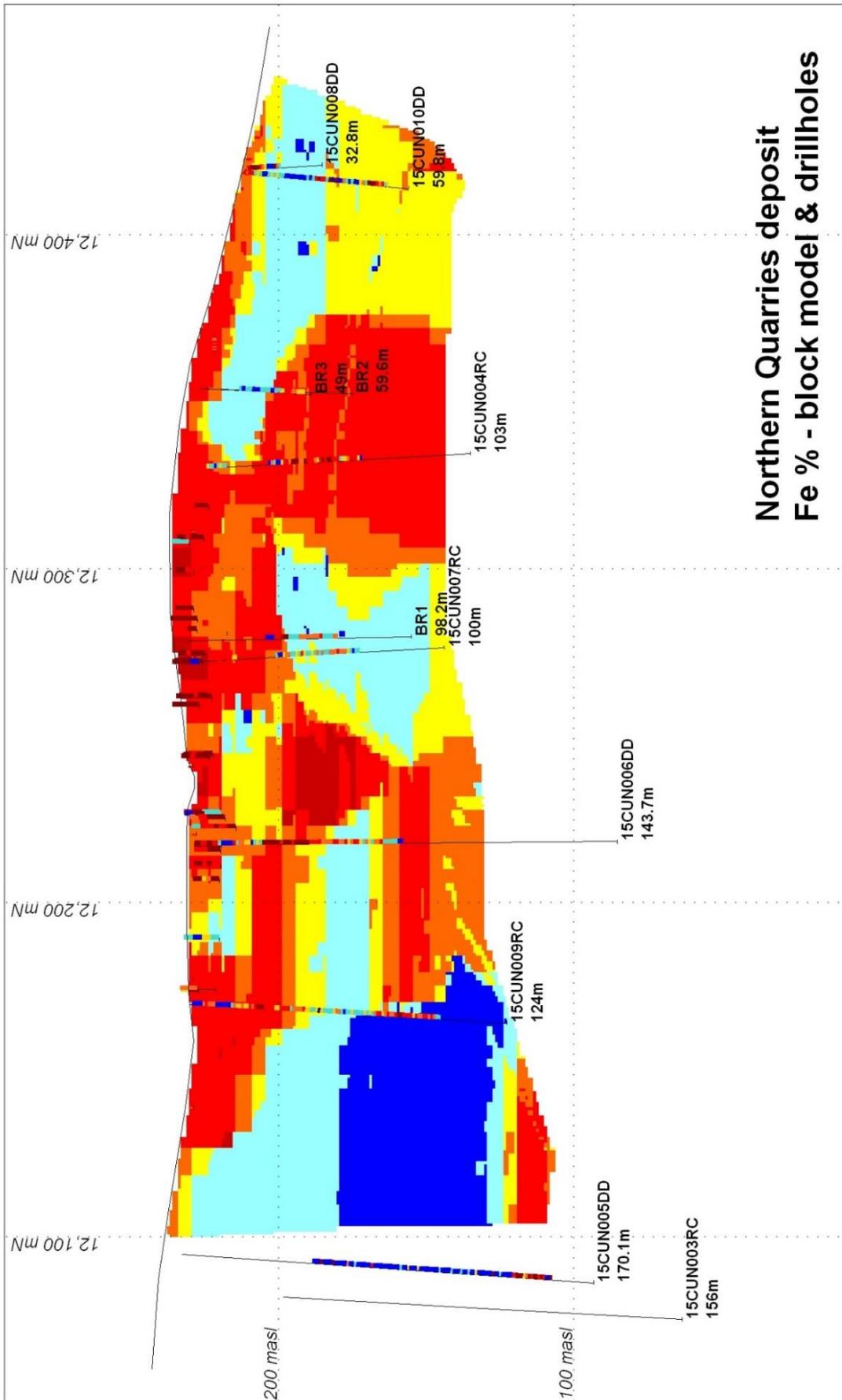


Figure 2.7: Long section looking northwest, Northern Quarries resource, legend in figure 2.6.

### **2.2.2 Copper Exploration**

In mid-2017 a 251.5m diamond drill hole was drilled to test beneath the old Copper King mine. A DHEM survey was also conducted. Neither of these two bodies of work were reported in the 2017 annual report but are detailed herein.

### **3.0 Exploration completed during the reporting period**

#### **3.1 Introduction**

Work conducted on EL 6/2005 during the reporting year consisted of

1. Efforts to have the mine lease application accepted by Mineral Resources Tasmania.
2. Metallurgical testwork on Cuprona ore samples.

#### **3.2 Mine lease application**

Efforts were made to have the mine lease application made during the 2017/18 year accepted by Mineral Resources Tasmania in the face of opposition by the relevant landowners.

#### **3.3 Cuprona (Northern Quarries) metallurgical testwork**

The Northern Quarries deposit consists of a mixture of hematite and silica. Production of a saleable hematite direct ship ore would benefit from some form of separation of hematite and silica rich zones.

Recent developments in rock sorting technology by manufacturers such as Tomra have the potential to be game changers for a number of deposits.

In order to test the utility of rock sorting technology to the Northern Quarries deposit 26m of diamond drill core from 26m to 51m in DDH CUN010DD was sent to Tomra in Sydney for a preliminary trial of rock sorting.

#### **3.4 Copper King mine drilling and downhole EM**

##### **3.4.1 Introduction**

A single diamond drill hole of 251.5m was drilled beneath the old Copper King mine in March 2017 but was not reported in the 2016/17 annual report. A downhole EM survey conducted in June 2017 was also not reported. Both activities are reported herein.

##### **3.4.2 CKDD1**

A decision was made to test the deposit beneath the old workings.

The old level plans in Butler (1970) were digitized and georeferenced.

In addition drill holes CK1, CK2, CK3 and CK4 drilled in the late 1960's by the Department of Mines and were georeferenced from locations shown in plan 8/88 in Whitehead (1988).

The diamond drill hole was targeted to test the Copper King mineralisation down plunge approximately 100m below the old workings. The hole was drilled at -60° to 293° (true north) to a depth of 251.5m in March 2017.

##### **3.4.3 Downhole EM**

The hole was also tested with the company's in-house DigiAtlantis DHEM system. The survey was conducted in June 2017. The survey was carried out by Graduate geophysicist Tyler Williams with technical advice from John Bishop and Kate Hine of Mitre Geophysics.

The acquisition parameters are summarized in Table 3.1 below.

**Table 3.1: System specifications and acquisition parameters**

<b>Receiver Specification</b>	
Instrument Type	DigiAtlantis System (Panasonic Toughbook and DigiAtlantis Controller)
Sensor	DigiAtlantis 3D Probe (triaxial fluxgate magnetometer)
Measured Components	A (axial); U (orthogonal to A in the (local) plane of the hole trace; V (orthogonal to A and U, such that $\mathbf{U} \times \mathbf{V} = \mathbf{A}$ )
Measurement Units (B-Field)	pT/A (pico Teslas per Amp)
<b>Transmitter Specification</b>	
Transmitter	EMIT SMARTx4
Current Source	6 kVa Diesel Generator
Nominal Output	20 - 40 Amps / 120 - 180 Volts
Loop size	200 x 300m
Waveform	Square Wave 50% Duty Cycle
Base Frequency	4.167Hz (n.b. if re-surveyed as recommended, this could be increased to 8Hz)

## **4.0 Discussion of Results**

### **4.1 Mine Lease Application**

A mine lease application requires accompanying compensation agreements with all private landholders whose land lies (wholly or partially) within the area of the application as well as an adequate mine plan.

The Northern Quarries deposit lies partially on private farmland.

During the exploration phase the farmers were happy to allow access for work to take place including drilling. As compensation the farmers accepted the drilling of a water bore and construction of a gravel road to the site.

However, it was clear from the objection received from the farmers regarding the mine lease application that whilst they were happy with the exploration work they were going to fight the granting of the mine lease. A meeting to discuss compensation resulted in an agreement to have the land valued by an independent valuer, however, when the time came for the valuer to access the property and carry out his work the farmers changed their mind and the valuer was not allowed access. Discussions with the farmers informally saw them asking for a compensation figure in excess of that considered reasonable by Lottah management and talks stalled.

Concurrently the mine plan was rejected by Mineral Resources Tasmania. At the time the mine plan was generated it was understood that the proximity of dwellings to blasting during mining would be a potential show stopper, however, advice received from Forze Explosive Services (a Tasmanian blasting company based in Margate) that they believed that the mining operation and the necessary blasting could be achieved to safe standards encouraged Lottah to proceed with the mine lease application.

Forze had carried out some desktop work to justify their belief but needed to be able to carry out some field testwork to allow the determination of actual parameters necessary to validate their modelling. This work would have involved the drilling of around 12 or so 10m deep holes, the placing and initiation of small explosive charges at the bottom of each hole, and the monitoring of beneath surface ground vibrations and above surface over pressure by monitors placed next to each of the proximal dwellings. Unfortunately Lottah was not given permission by the relevant landowners to either (1) carry out the blast testing, or (2) place monitors at each dwelling.

Lottah was unable to use the "Notice of Intention to Enter Private Land" form to force access to be allowed to carry out this work as the specific activity of 'blast testing and monitoring' is not included as an exploration activity under the 1995 Mineral Resources Development Act.

On the one hand the mine plan requires proof that Lottah can drill and blast safely in reasonably close proximity to dwellings, but on the other hand Lottah is not allowed to undertake the testwork which would show that such was possible.

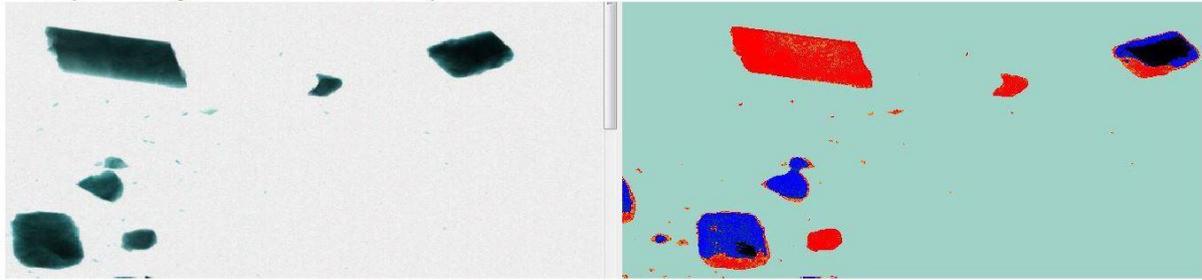
The only outcome of this work has been to demonstrate that the only agreement with a private landowner which an explorer can trust is a settled contract to purchase the property (i.e. you have to own the land) – any other agreement can be reversed as has taken place here.

### **4.2 Cuprona (Northern Quarries) metallurgical testwork**

The results of the rock sorting testwork are appended as appendix A.

A total of 101.5 kg of drill core was crushed and screened to produce a -8mm fraction (6.8kg), a 8-25mm fraction (18.1kg) and +25mm fraction 76.3kg (up to ~60mm).

Sorting was done based on transmitted x-rays differentiating between high density hematite and low density silica.



**Figure 4.1: Raw (left) and processed (right) XRT images of high and low-density particles. High-density particles are shown in blue/black, while low-density particles are shown in red. This image shows particles from the +25mm feed material using DE-XRT.**

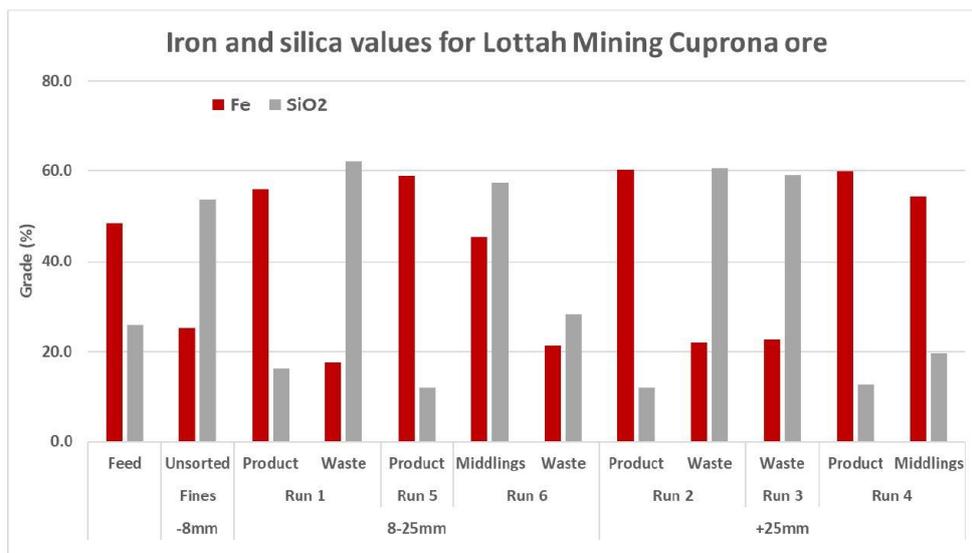
The 8-25mm and +25mm fractions were then each split into two halves to allow for two test runs for each fraction.

Runs 1 and 2 were straight waste/product splits for the 8-25mm and +25mm fractions respectively.

The other halves were then run through twice each (runs 5 and 6 for 8-25mm fraction and runs 3 and 4 the +25mm fraction) in order to generate a product/waste/middlings split for each fraction.

**Table 4.1: Cuprona samples showing weights and assays for each run**

	Run	Fraction	Fe (%)	SiO <sub>2</sub> (%)	Mass (kg)
-8mm		Feed	48.4	25.7	101.5
		Fines	25	53.6	6.8
		Unsorted			
8-25mm	Run 1	Product	56	16.1	6.4
		Waste	17.4	62.2	3.2
	Run 5	Product	58.9	11.9	4.3
	Run 6	Middlings	45.5	57.4	1.0
		Waste	21.3	28.3	3.2
	+25mm	Run 2	Product	60.2	11.9
		Waste	22	60.6	6.9
Run 3		Waste	22.6	59	7.9
Run 4		Product	59.9	12.5	14.4
		Middlings	54.3	19.7	13.7



**Figure 4.2: Cuprona samples showing weights and assays for each run**

Whilst the sorting was done a number of times with slightly different split ratios in combination we can say that from the initial 101.5kg at 48.4% Fe we were able to sort out 58.5kg i.e. ~58% of a DSO suitable product at a weighted average grade of 59.6% Fe.

### 4.3 CKDD1

DDH CKDD1 was drilled at -60° to 293° (true north) for 251.5m. Surveys indicate that the hole maintained a consistent dip finishing at -60.2°.

The first downhole survey, at 30m, shows the azimuth to be 287.6°, significantly than the 293° surveyed by hand held compass at the collar.

The hand held compass surveyed azimuth may be incorrect (the hole is now buried) or alternatively the hole has skipped in azimuth to 287.6°. Overall the hole swings right and finishes at 295°, i.e. around 1°/30m.

The hole path is satisfactory with the hole intersecting the Copper King Shear at the expected depth and directly beneath the old workings as desired.

The hole passed through a sandstone unit until 34.9m where it graded into a thick sequence of black shales with relatively minor though variable minor amounts of lighter grey thin mm scale interbeds of siltstone, intersected in three locations by demonstrable fault structures, i.e. at 61.9m to 62.5m with milled quartz vein material, and also 96.6m to 101.8m and 174.3m to 176.2m, the latter two associated with fold closures suggesting shearing across fold hinges, until 193.35m.

The shale>siltstone sequence shows variable bedding orientations (with regards to core axis) and localised tight small scale parasitic type folds. There is a suggestion that the shears between 96.6m to 101.8m and 174.3m to 176.2m are shears across major fold closures but this requires a more detailed structural analysis, in particular facing information, than has been done. Certainly the Burnie Formation shows tight folding on the scale of 10's of metres and so such is expected.

From 193.35m to 223.6m the hole intersects the Copper King Shear structure.

The Copper King Shear is a zone consists of a number of faults or more intensely sheared zones separating less deformed zones of country rock (most similar to the up hole sequence of rocks) consisting of black shale with variable but minor amounts of lighter grey siltstone, intruded in three locations by undeformed feldspar phyric felsic dykes cross-cutting at 35° to 60° (with respect to core axis) suggesting a sub-vertical orientation.

The log of the Copper King Shear is

193.35m - 193.8m. Milled and puggy black shale and quartz veins fragments. Upper contact at 40° to core axis.

193.8m - 195.4m. Yellow-brown feldspar phyric felsic dyke. Undeformed. Sharp upper and lower contacts.

195.4m - 198.85m. Black shale, largely undeformed.

198.85m - 199.35m. Yellow-brown feldspar phyric felsic dyke. Undeformed. Sharp upper and lower contacts at 35° and 40° to core axis respectively.

199.35m - 203.4m. Tightly folded and contorted shale and siltstone with brecciated and milled and contorted siderite>quartz veining

203.4m - 204.2m. Crush zone in black shale.

204.2m - 205.8m. Strongly sheared shale with quartz>siderite veining conformable to shear fabric at 40° to core axis.

205.8m - 207.05m. Grey siltstone, only weakly deformed.

207.05m - 207.7m. Yellow-brown feldspar phyric felsic dyke. Undeformed. Sharp upper and lower contacts at 50° and 60° to core axis respectively.

207.7m - 208.65m. Grey siltstone, only weakly deformed.

208.65m - 208.95m. Yellow-brown feldspar phyric felsic dyke. Sharp upper and lower contacts at 45° to core axis.

208.95m - 212.6m. Milled and brecciated black shale with milled quartz+siderite veining.

212.6m - 222.8m. Zone of mixed coherent siltstone>shale with irregularly oriented, occasionally brecciated and/or sheared quartz+siderite veins up to 20cm in thickness. Includes minor chalcopyrite in quartz+siderite vein from 213.2m to 213.5m

222.8m - 223.6m. Grey rock flour with milled quartz fragments.

From 223.6 to 251.5m the hole intersected a relatively undeformed unit of finely interbedded black shales and grey siltstone.

The only sulphide mineralisation intersected in the shear zone was from 213.2m to 213.5m with a ~3mm thick mass of chalcopyrite in quartz+siderite vein. The intersection has not been assayed at present.

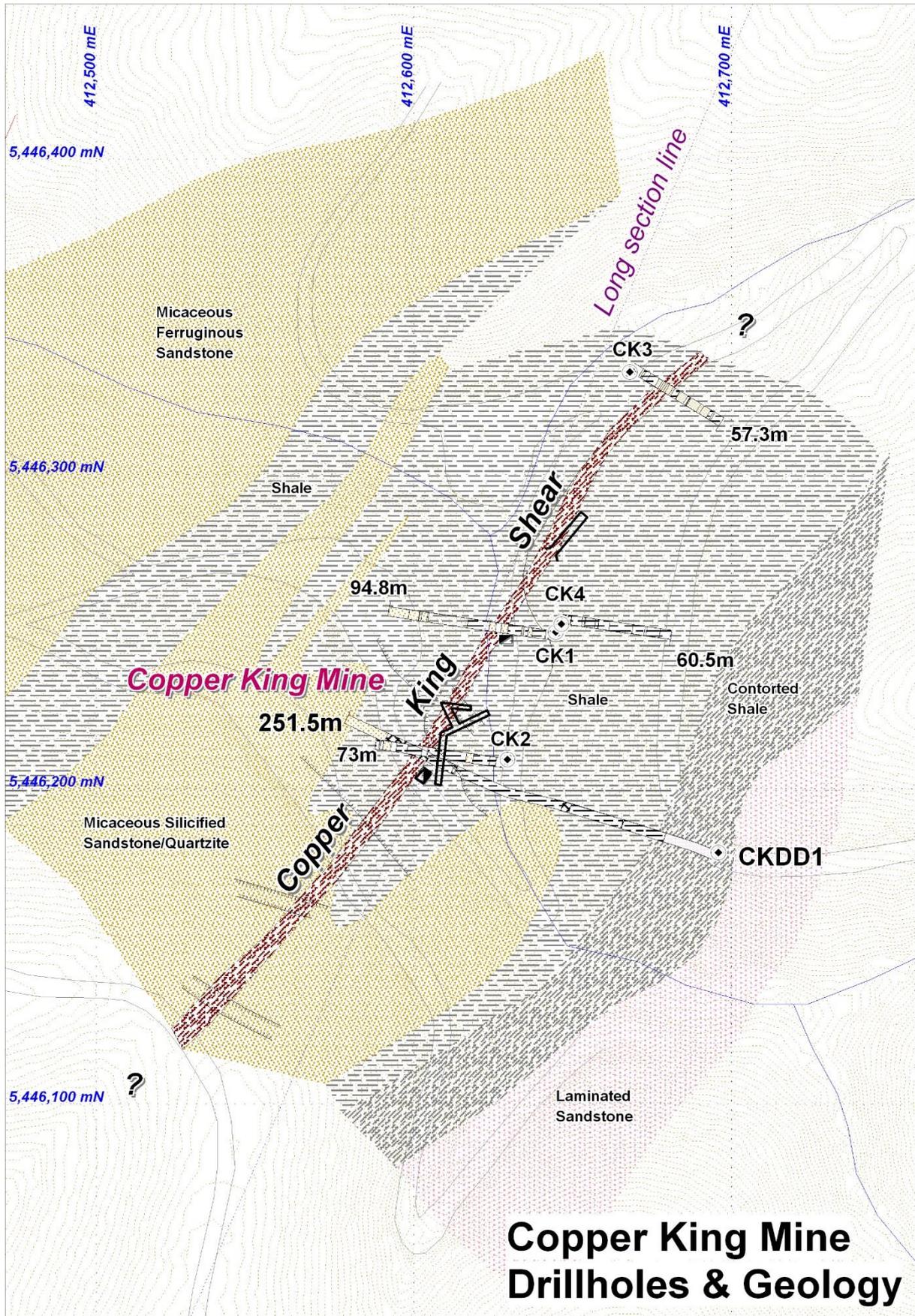
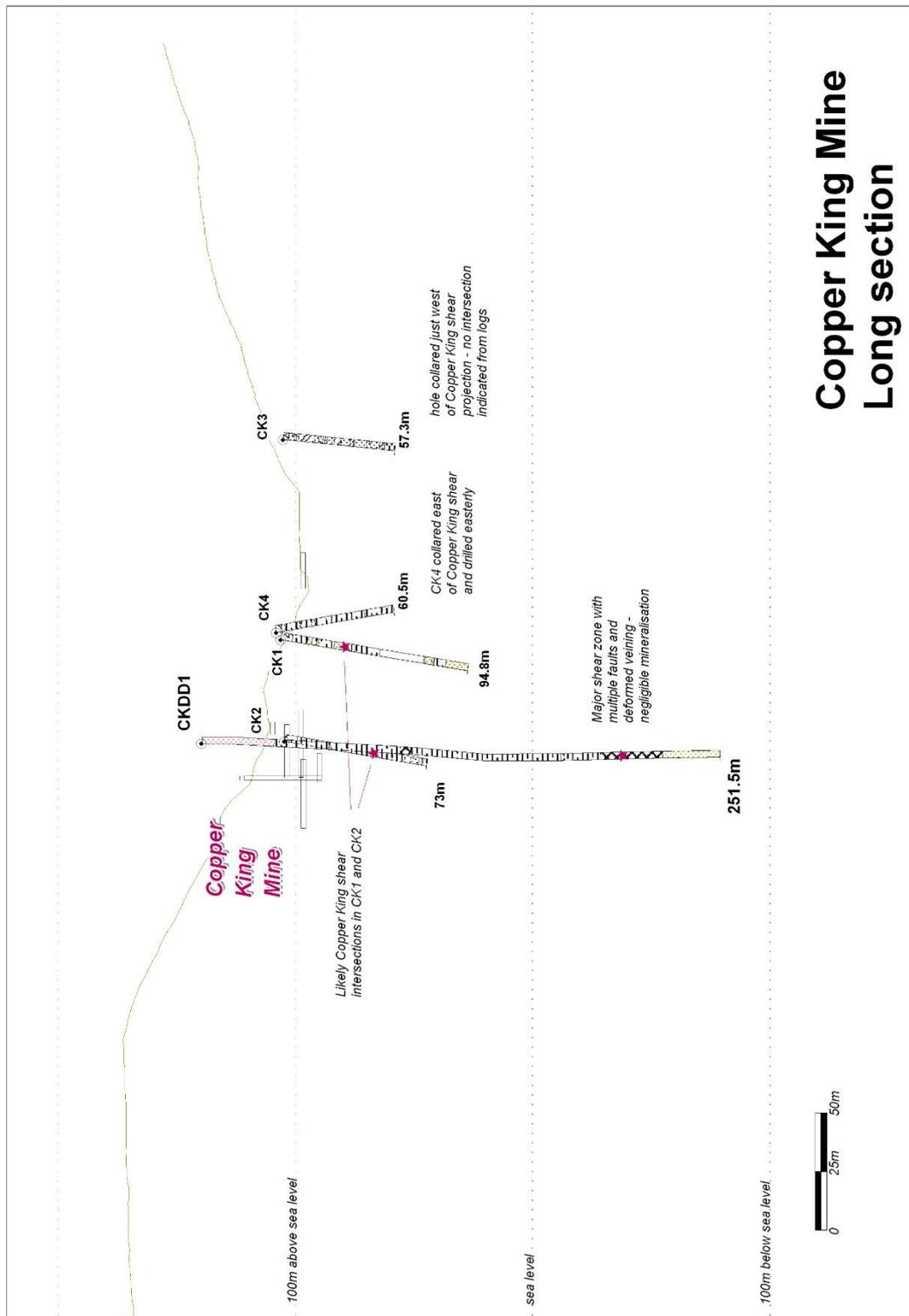


Figure 4.3: Copper King mine geology and drilling showing location of CKDD1.



**Figure 4.4: Copper King mine long section showing the old workings and down hole geology for CKDD1 and earlier holes CK1, CK2, CK3 and CK4.**

#### 4.4 Down hole EM

The diamond drill hole was surveyed by down hole EM using the company's in-house DigiAtlantis EMIT system.

The DHEM survey was carried out using one offset loop with a nominal size of 200m x 300m. Whilst it was appreciated that a collar loop would have been more desirable from an interpretation point of view, there was no ready access to the east of the drill hole and a good coupling was obtained with an offset loop, CKDD01\_loop1 (see figure 4.5).



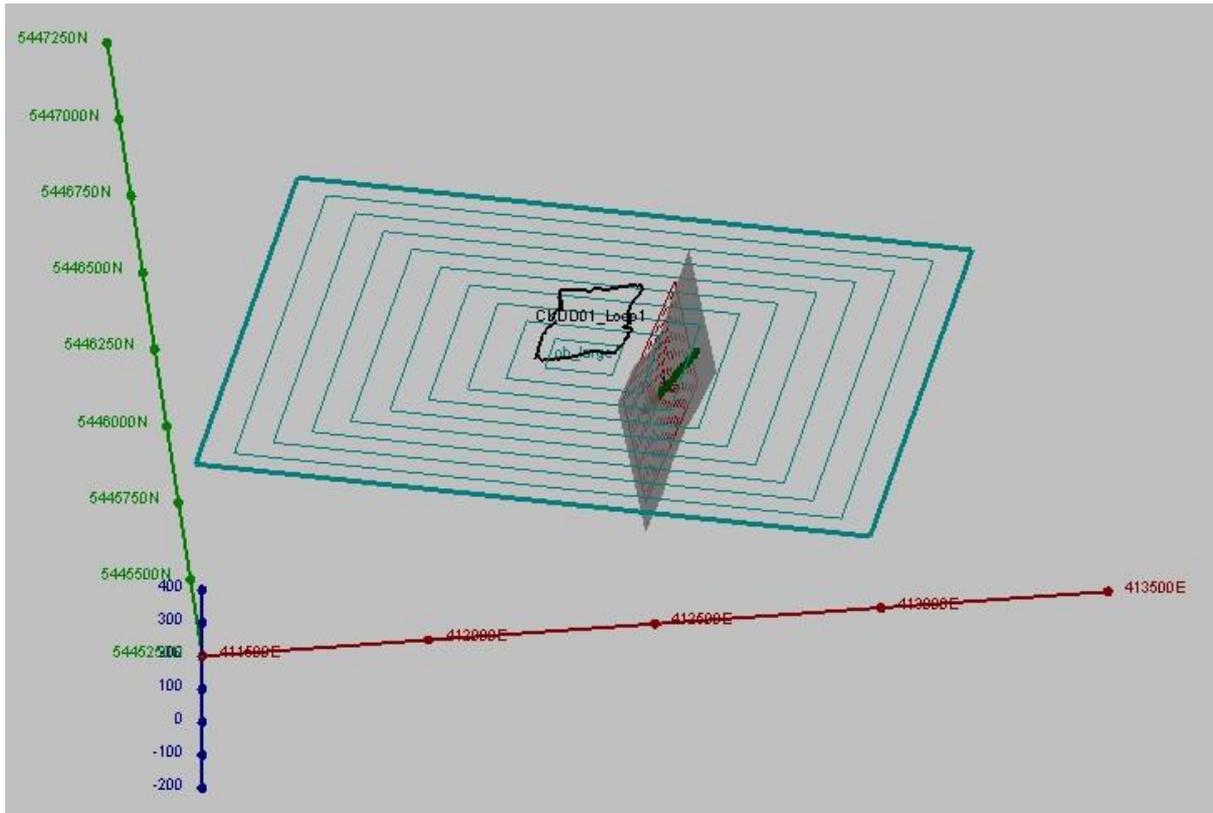
**Figure 4.5: Loop layout for Copper King DDH CKDD1 DHEM survey.**

The survey took four days with three people employed: two days to lay out the loop; a day for data acquisition and another day to retrieve the loop. The loop was surveyed by hand held GPS and the coordinates (in AGD94 Zone 55) are included in the digital data accompanying this memorandum.

CKDD01 intersected the target zone between 212.6m and 215.7m, i.e., a ~3m discrepancy between the possible DHEM indicated intersection and the geological logging. There was also a ~4m difference in the recorded depth when the probe was brought back to the surface. These differences are attributed to loose winding of the downhole cable on its spool. The whole 1.5km length needs to be taken off the spool and wound tightly back on.

Modelling of the data has shown that the recorded data can be largely explained by two weak conductors: an (inhomogeneous) overburden and a fault zone, the Copper King Shear Zone, which contains the Copper King workings (figure 4.6).

There is also a hint of a possible third, relatively small, conductor in the region of the shear zone, however, much more detailed information is needed in this area before the (tentative) response can be modelled.



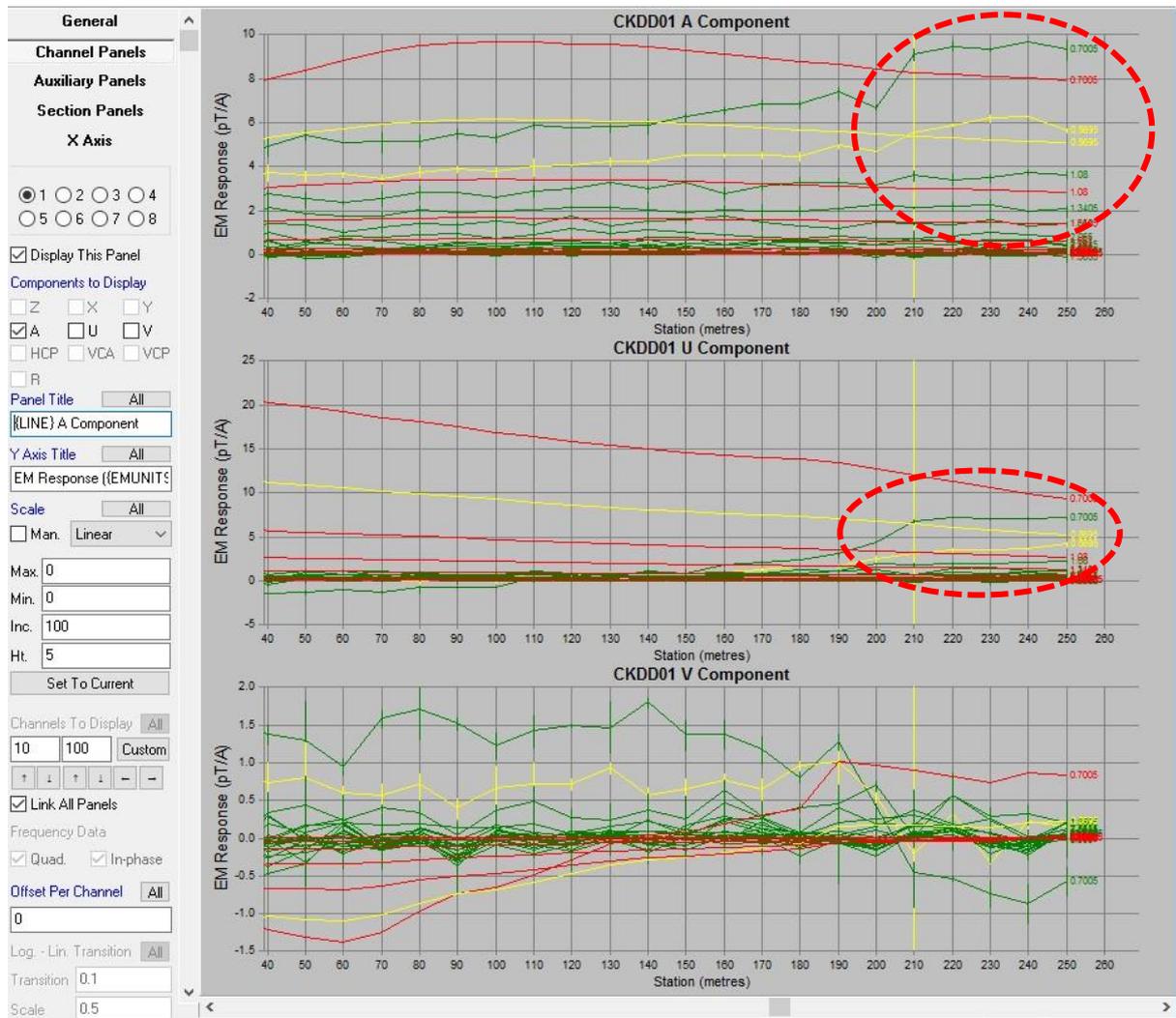
**Figure 4.6: Modelling of conductive overburden (aqua lines) and Copper King Shear (grey shape) with drill hole in green and loop in dark purple.**

The DHEM data acquired for CKDD01 indicates a potential off-hole anomaly identified by a slow decay in intermediate to late time channels.

The observed early time recorded response is interpreted to be largely due to the over-burden, which is likely to be non-planar and possibly heterogeneous in the area of the loop (thicker sediment in the valley; flowing river across the loop; relatively rugged topography). However, a reasonable fit (figure 4.7) was obtained with a simple dipping rectangular over burden.

The Copper King Shear Zone (CKSZ) has some influence on the observed data but is not a strong conductor and the graphitic shales and other logged fault zones appear to have had no effect.

The combined overburden and CKSZ give an acceptable response to intermediate times, but there is a noticeable 'dip' in the axial data at the 200m reading in later channels with a noticeable rise in amplitude below that. The dip is only a single point and may be an intersection-type response; however, it is too poorly designed to be sure and more detail is required to confirm this and to better define the possible deeper increase in amplitude.



**Figure 4.7:** EM responses for all channels shown using the Maxwell interpretative/modelling software.

## 5.0 Conclusions

(1) Further work is required on the mine lease application, and in particular the purchase of the properties close to the deposit, to allow a realistic mine plan to be generated.

(2) Rock sorting has the capacity to generate a DSO product at 59.6% Fe.

It is proposed to carry out bulk sampling in the coming months for more detailed, quantified sorting testwork at Tomra in Sydney. This will require the collection of ~1 ton of material.

(3) Drill hole CKDD1 successfully intersected the Copper King Shear beneath the old Copper King mine workings. Unfortunately the structure is only very weakly mineralised where it was intersected.

(4) DHEM on CKDD1 appears to have located a weak off hole conductor though not at a size and strength at this depth for the source of the anomaly to be considered an economically viable target. Further DHEM surveying is required to allow for better modelling of this anomaly.

## **6.0 Environment**

Lottah is aware of a drill collar requiring capping and burial which will be done in the coming months. Otherwise there are no outstanding environmental issues.

## 7.0 Expenditure

	\$
Geology	3,000
Geochemistry	500
Geophysics	0
Remote Sensing	0
Drilling	0
Gridding	0
Land Access	0
Rehabilitation	0
Feasibility Studies	10,000
Other	0
Administration	1,000
Total	14,500

## 8.0 References

- Anon, (2008). Blythe Project, Northern Tasmania Annual Report for EL6/2005 ("Cuprona") unpub. company rpt. Iron Mountain Mining Limited **[TCR 08\_5768]**
- Atkinson, W.J. (1958). *The Preliminary Investigation of Iron Deposits in the Burnie-Penguin Area* unpub. company rpt. King D, Rio Tinto Australian Exploration Pty Ltd **[TCR 58\_0240]**
- Bainbridge, I., Clarke, D., 1903. Report - The Blythe River Iron Deposits. Mineral Resources Tasmania Open File Report **[TCR 03\_4891]**.
- Banwell, L.D. (1982). *Exploration Licence 8/77 - Riana, Progress Report on Exploration During the Period 1/1/80 - 31/7/81* unpub. company rpt. Commonwealth Aluminium Corporation Ltd, The Shell Company of Australia Ltd **[TCR 82\_1784]**
- Blake, F. (1957a). Blyth River and Cuprona Areas Min. Res. Tasm. **[TR2\_25\_33]**
- Blake, F. (1957b). Blythe River and Cuprona Iron Areas. Mineral Resources Tasmania Report **[UR1957\_096\_99]**.
- Boyd, A.A, Young, W., Higgins, J.M., Gibson, C.G. (1919). *Report of Experts on the Blythe River Iron Deposit, Burnie*, Tasmania unpub. company rpt. O'Keefe C **[TCR 19\_0022]**
- Byrne, D.J., 1969. Composite Plan, Natone Area. Minops Pty Ltd. Mineral Resources Tasmania Open File Report **[TCR 69\_0574]**
- Butler, A.R. (1968). *Report on Copper King Mine, Cuprona* unpub. company rpt. Mr Symons **[TCR 70\_0703]**
- Davis, C.W. (1990). *Relinquishment Report Exploration Licence 30/86 Cuprona District - N.W. Tasmania* unpub. company rpt. Davis C W **[TCR 90\_3182]**
- Darby, J.H. (1900), *Report on Blythe River Iron Mine Ltd.*
- Erdmanis, J., 1969. Progress Report to 30th September, 1969 on Exploration Licences 13/68 and 14/68 Tasmania, for Hinkley D W, McDonald E H, Minops Proprietary Limited.
- Fitzgerald, F.G. (1993). *EL 9/92 Dial Range Annual Report Jul 1992-June 1993* unpub. company rpt. Pasminco Australia Ltd (Exploration) **[TCR 93\_3447]**
- Gee, R.D. (1977a). Geological Atlas 1 mile series, zone 7 sheet No. 28 (8015N) Burnie Tas. Geological Survey Explanatory Report. Grace, D.P., 1972. Natone Area - Phase I Report. Tasminex N.L. Mineral Resources Tasmania Open File Report **[TCR 72\_0897]**.
- Gee, R.D. (1977b). *Geological Survey Explanatory Report, Geological Atlas 1 mile series, zone 7 sheet No. 28 (8015N) Burnie* Min. Res. Tasm. **[ER8015N0]**
- Grace, D.P. (1972). *Natone Area - Phase I Report.* unpub. company rpt. Tasminex NL **[TCR 72\_0897]**
- Hall Relph & Associates Pty Ltd, 1970. Natone Copper- Iron Prospect. Tasminex N.L. Mineral Resources Tasmania Open File Report **[TCR 70\_0665]**
- Hughes, T.D. (1969). *Natone Area - EL 14/68 and EL 13/68* unpub. company rpt. Hinkley D W, McDonald E H **[TCR 69\_0553]**
- Jack, R.H. (1965). *Natone manganese deposit* Min. Res. Tasm. **[TR9\_20\_21]**
- James, P.L., Liddy, J., Manson, W.St.C, 1962. Blythe River Iron Ore Beneficiation. Mineral Resources Tasmania Report **[TR6\_214\_222 - R386]**
- Karajas, J. (2006). Blythe Project, Northern Tasmania Annual Report for EL6/2005, Cuprona unpub. company rpt. Red River Resources Limited **[TCR 06\_5341]**

- Karajas, J. (2007). Blythe Project, Northern Tasmania, Annual Report for EL 6/2005 (Cuprona) unpub. company rpt. Red River Resources Limited **[TCR 07\_5508]**
- Kusnandar, K.K., Zlatkov, G. and Mayer, A. (2009). Blythe Project, Northern Tasmania Annual Report for EL6/2005 ("Cuprona") unpub. company rpt. Iron Mountain Mining Limited **[TCR 09\_5921]**
- Kusnandar, K.K., Zlatkov, G. and Mayer, A. (2010). Blythe Project, northern Tasmania. Combined annual report for tenements - EL6/2005, EL15/2006, EL35/2006, EL37/2006, EL18/2007, EL53/2007 unpub. company rpt. Iron Mountain Mining Limited **[TCR 10\_6037]**
- Kusnandar, K.K., Zlatkov, G. and Mayer, A. (2010). Blythe Project, northern Tasmania. Combined annual report for tenements EL6/2005, EL15/2006, EL35/2006, EL18/2007, EL53/2007, EL25/2009 for the period ending 19 November 2010 unpub. company rpt. **[TCR 10\_6167]**
- Macdonald, E.H. (1965). *Blythe River Iron Ore Deposits near Burnie, Tasmania* unpub. company rpt. Kathleen Investments (Australia) Ltd, Pickands Mather and Company International **[TCR 65\_0410]**
- MacDonald, G. (2017) EL 6/2005 "Cuprona" Annual Report on Exploration. unpub. report for ottah Mining Pty Ltd.
- Montgomery, A. (1894) *Report on a deposit of iron ore at the Blythe River* **[OS211]**
- Mortimer, R. (2007). Blythe Project Natone/Camena Prospects, EL6/2005, EL16/2006, Gravity Surveying 9/2006 Summarised Interpretation unpub. company rpt. Red River Resources Limited **[TCR 07\_5508A]**
- Noldart, A.J. (1966). *Cuprona iron deposit* Min. Res. Tasm. **[TR10\_55\_64]**
- Nye, P.B. (1937). *Report on the Blythe River Iron Deposits* unpub. company rpt. Paterson J D, Ralph H, Rankin R A, Tasmania Department of Mines **[TCR 37\_0068]**
- Nye, P.B., (1941). Report on Woodstock Copper Mine, Natone. Mineral Resources Tasmania Report **[UR1941\_017\_20]**
- Pearson, A. (1927). *The Husetop Area Laurel Creek and Blythe River Districts* unpub. company rpt. Gardner G D, Langham M, Niarana Prospecting Syndicate, Radford H **[TCR 27\_0036]**
- Ruxton, P.A. (1982). E.L. 8/77 - *Riana, Progress Report on Exploration During the Period 1/8/81 to 1/7/82*. unpub. company rpt. Commonwealth Aluminium Corporation Ltd, The Shell Company of Australia Ltd **[TCR 82\_1820]**
- Ruxton, P.A., 1983a. - E.L. 8/77 - *Riana, Progress Report on Exploration During the Period 2/7/82 to 1/9/83*. Shell Company of Australia Ltd. Mineral Resources Tasmania Open File Report **[83\_2040]**
- Ruxton, P.A. (1983). *The Natone Pyrrhotite - Magnetite Skarn N.W. Tasmania* unpub. company rpt. Comalco Ltd, The Shell Company of Australia Ltd **[TCR 83\_2041]**
- Ruxton, P.A., 1984. - E.L. 8/77 - *Riana, Progress Report on Exploration During the Period 2/7/83 to 1/9/84*. Shell Company of Australia Ltd. Mineral Resources Tasmania Open File Report **[TCR 84\_2142]**
- Ruxton, P.A., 1982 - E.L. 8/77 - *Riana, Progress Report on Exploration During the Period 1/8/81 to 1/7/82*. Shell Company of Australia Ltd. Mineral Resources Tasmania Open File Report **[TCR 82\_1820]**
- Ruxton, P.A., 1983b. *The Natone Pyrrhotite - Magnetite Skarn N.W. Tasmania*. Shell Company of Australia Ltd. Mineral Resources Tasmania Open File Report **[TCR 83\_2041]**

- Reid, A.M. and Twelvetrees, W.H., 1919. The Iron Ore Deposits of Tasmania. Geological Survey Tasmania Mineral Resources No. 6.
- Schneider, M., 1983. Interpretation Report, Airborne electromagnetic Survey, Barringer `INPUT` System, Riana, Highclere, Loongana Areas. Geoterrex Pty Ltd. for The Shell Company of Australia Ltd.
- Thomas, D.E. and Henderson, Q.J. (1943). Some iron deposits in the vicinity of Burnie Min. Res. Tasm. **[UR1943\_205\_221]**
- Twelvetrees, W.H. (1901). *Report on Blythe River Iron Ore Deposit* Min. Res. Tasm. **[OS\_166]**
- Twelvetrees, W.H. (1903). *Report on the Dial Range and Some Other Mineral Districts on the North-West Coast of Tasmania* Min. Res. Tasm. **[OS\_211]**
- Twelvetrees, W.H. (1905). *Report on North-West Coast mineral deposits* Min. Res. Tasm. **[OS\_231]**
- Twelvetrees, W.H. (1909). *Gunns Plains, Alma, and other mining fields, north-west coast* Min. Res. Tasm. **[GSB05]**
- Twelvetrees, W.H. (1909). *Gunns Plains, Alma and other mining fields, north-west coast* Min. Res. Tasm. **[OS\_249]**
- Twelvetrees, W.H., 1918. Deposits of iron ore and other raw materials likely to be used in proposed electro-metallurgical industries. Mineral Resources Tasmania Report **[URMISCA\_088\_11]**
- Twelvetrees, W.H. (1919). *The Blythe River Iron Ore Deposits. (Extract from Mineral Resources No. 6)* Min. Res. Tasm. **[UR1861\_1920\_187\_199]**
- Whitehead, C.H. (1988). *Cuprona Area - N.W. Tasmania, Annual Report - 1988/89* unpub. company rpt. Davis C W **[TCR 88\_2791]**
- Whitehead, C.H. (1989). *Cuprona Area - N.W. Tasmania, Annual Report - 1988/89* unpub. company rpt. Davis C W **[TCR 89\_2945]**

## 9.0 File listing

Exploration Work Type	Filename	File format
Report	EL062005_201809_01_Report.pdf	pdf
	EL062005_201809_02_SL1	xlsx
	EL062005_201809_02_DS1	xlsx
	EL062005_201809_02_DL1	xlsx
	EL062005_201809_03_appendixB_Tomra_Cuprona_Sorting_of_Iron_Ore.pdf	pdf
	EL062005_201809_04_AppendixC_Copper_King__CKDD1_DHEM_data	zip
File Verification Listing (this file)	EL062005_201809_FileListing.xls	xls

**Appendix A – CKDD1 drill hole details and log**

<b>collar coordinates (MGA94)</b>		
<b>easting</b>	<b>northing</b>	<b>rl</b>
412,696mE	5,446,180mN	139.3masl

<b>depth (m)</b>	<b>dip</b>	<b>Azimuth (MGA94)</b>
0	-60	293
30	-59.2	287.6
90	-60	287
120	-60.5	283.5
156	-61.1	293.3
186	-60.8	295.6
240	-60.2	295

<b>From</b>	<b>To</b>	<b>Lithology</b>	<b>Description</b>
0	34.9	Siltstone	<b>Siltstone &gt;&gt; Shale.</b> Siltstone with minor thin (mm's) shale interbeds. Oxidised on fracture surfaces. Brecciated quartz vein from 27.2m to 28.2m at moderate angles to core axis.
34.9	61.9	Shale	<b>Shale &gt; Siltstone.</b> Black shale with lesser thin (mm's) grey siltstone interbeds. Occasional quartz+/-siderite veins to 20cm often brecciated/deformed.
61.9	62.5	Fault	<b>Minor Fault.</b> Puggy milled black shale with milled quartz vein fragments.
62.5	96.6	Shale	<b>Shale &gt; Siltstone.</b> Black shale with lesser thin (mm's) grey siltstone interbeds. Only very occasional quartz+/-siderite veins to 20cm often deformed.
96.6	101.8	Fault	<b>Minor Fault/Fold Hinge.</b> Sheared and puggy black shale. Minor fault at low angle to core axis. S0 parallel to core axis in part so probably fault across fold hinge.
101.8	174.3	Shale	<b>Shale &gt; Siltstone.</b> Black shale with lesser thin (mm's) siltstone interbeds. Occasional quartz+/-siderite veins to 20cm often deformed.
174.3	176.2	Fault	<b>Minor Fault/Fold Hinge.</b> Puggy milled shale with milled quartz vein fragments. S0 at low angle to core axis suggesting probably fault across fold hinge.
176.2	193.35	Shale	<b>Shale.</b> Black shale with lesser thin (mm's) grey siltstone interbeds. Occasional quartz+/-siderite veins to 20cm but generally <50mm.
193.35	223.6	Shear Zone	<b>Major Shear Zone - "Copper King Shear Zone".</b> Major shear structure consisting of discrete faults and milled crush zones separated by more weakly deformed siltstone and shale with quartz+/-siderite veins, and undeformed feldspar phyric dykes.

			193.35m - 193.8m. Milled and puggy black shale and quartz veins fragments.
			Upper contact at 40° to core axis.
			193.8m - 195.4m. Yellow-brown feldspar phyric felsic dyke. Undeformed. Sharp upper and lower contacts.
			195.4m - 198.85m. Black shale, largely undeformed.
			198.85m - 199.35m. Yellow-brown feldspar phyric felsic dyke. Undeformed. Sharp upper and lower contacts at 35° and 40° to core axis respectively.
			199.35m - 203.4m. Tightly folded and contorted shale and siltstone with brecciated and milled and contorted siderite>quartz veining
			203.4m - 204.2m. Crush zone in black shale.
			204.2m - 205.8m. Strongly sheared shale with quartz>siderite veining conformable to shear fabric at 40° to core axis.
			205.8m - 207.05m. Grey siltstone, only weakly deformed.
			207.05m - 207.7m. Yellow-brown feldspar phyric felsic dyke. Undeformed. Sharp upper and lower contacts at 50° and 60° to core axis respectively.
			207.7m - 208.65m. Grey siltstone, only weakly deformed.
			208.65m - 208.95m. Yellow-brown feldspar phyric felsic dyke. Sharp upper and lower contacts at 45° to core axis.
			208.95m - 212.6m. Milled and brecciated black shale with milled quartz>siderite veining.
			212.6m - 222.8m. Zone of mixed coherent siltstone>shale with irregularly oriented, occasionally brecciated and/or sheared quartz+siderite veins up to 20cm in thickness. Includes minor chalcopyrite in quartz+siderite vein from 213.2m to 213.5m
			222.8m - 223.6m. Grey rock flour with milled quartz fragments.
223.6	251.5	Siltstone	<b>Siltstone&gt;&gt;Shale.</b> Grey siltstone with thin (mm's) black shale interbeds. Undeformed.
251.5			<b>End of hole</b>

## Appendix B – Tomra Rock Sorting Report

**Appendix C – Copper King CKDD1 DHEM data – supplied digitally**